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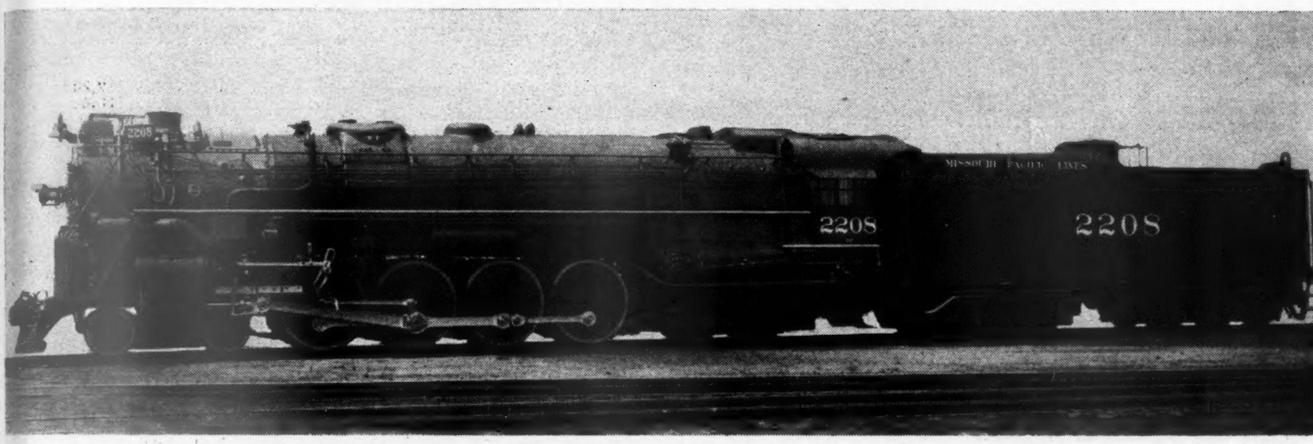
RAILWAY
MECHANICAL ENGINEER

Missouri Pacific buys 15

4-8-4 Freight Locomotives



Baldwin Locomotive Works delivers new power for freight service on the eastern lines — Engines weigh 496,000 lb. and have tractive force of 67,200 lb. with 73-in. driving wheels

THE Baldwin Locomotive Works recently delivered an order of fifteen fast freight locomotives of the 4-8-4 type to the Missouri Pacific. These locomotives have a total engine weight of 496,000 lb.; 67,200 lb. tractive force; 73-in. drivers and 285 lb. boiler pressure. These new locomotives are at the present time being used to handle fast freight trains on the eastern lines of the road between St. Louis, Mo., and Kansas City.

Boiler Construction and Design

The boiler is the conical type having an inside diameter of 89¾ in. at the first ring and an outside diameter of 100 in. at the third ring, the second ring being tapered. The barrel courses are fabricated of carbon steel with butt joint multiple riveted longitudinal seams. The plate thicknesses for the three barrel courses are 1⅛ in., 1 7/32 in. and 1¼ in., respectively. The fireboxes of these boilers have a grate area of 106 sq. ft. with a firebox width of 102¼ in. and a firebox length of 150⅛ in. The combustion chamber is 72 in. long. The plate thicknesses in the firebox are ⅜ in. for the sides, crown and furnace door sheet; ½ in. for the back flue sheet; ⅝ in. for the front flue sheet and 1 in. for the roof sheet. The firebox roof sheet is seal welded to 9/16 in. side sheets. The mud ring water spaces are 6 in. at the front and 5 in. at the sides and back. The boilers are fitted with 70, 2¼-in. No. 11 B. W. G. tubes and 178 4-in. No. 9 B. W. G. flues, all 21 ft. over the tube sheets.

The fireboxes are seal welded at the mud ring, fire door, back head to roof, throat sheet to barrel, roof sheet to barrel, side sheets to roof sheets, crown sheet, back flue sheet to combustion chamber and front flue sheet to flue sheet ring.

A complete installation of flexible staybolts is used in the combustion chamber, the breaking zones of the firebox and in the throat sheet. In these locations, Flannery type D bolts are used with UW sleeves. The firebox volume is 736 cu. ft. The boilers are equipped with the Elesco Type E improved 90-unit superheater and the American Throttle Company's multiple front-end throttle. Fuel is fed by means of a Standard Type BK stoker. The feedwater system for these boilers consists of one Edna NL injector and a Worthington type 6SA feedwater heater having both cold water and hot water pumps located on the left side of the locomotive. The fireboxes are fitted with three Nicholson thermic syphons, two of which are located in the firebox and one in the combustion chamber.

Foundation and Running Gear

The bed of these locomotives consists of a General Steel Castings Corporation's steel casting with cylinders, back heads and several cross ties cast integral. The engine trucks are the four-wheel type supplied by the General Steel Castings Corporation and are of the constant resistance inside bearing design. The engine trucks have

General Dimensions, Weights and Proportions of the Missouri Pacific 4-8-4 Type Locomotives

Builder	Baldwin Locomotive Works
Type of locomotive	4-8-4
Road class	26S, 63
Road numbers	2201—2215
Date built	August, 1943
Service	Freight
Dimensions:	
Height to top of stack, ft.-in.	16—1
Height to center of boiler, ft.-in.	10—7½
Width overall, in.	129
Cylinder centers, in.	92½
Weights in working order, lb.:	
On drivers	280,000
On front truck	94,000
On trailing truck	122,000
Total engine	496,000
Tender (light)	152,400
Tender (loaded)	359,000
Wheel bases, ft.-in.:	
Driving	19—3
Rigid	12—10
Engine, total	47—1
Engine and tender, total	93—5¾
Wheels, diameter outside tires, in.:	
Driving	73
Front truck	36
Trailing truck	42
Engine:	
Cylinders, number, diameter and stroke, in.	26x30
Valve gear, type	Walschaerts
Valves, piston type, size, in.	14
Maximum travel, in.	7
Steam lap, in.	1¼
Exhaust clearance, in.	line and line
Lead, in.	3/10
Cutoff in full gear, per cent	85
Boiler:	
Type	Conical
Steam pressure, lb. per sq. in.	285
Diameter, first ring, inside, in.	92
Diameter, largest, outside, in.	100
Firebox, length, in.	150⅛
Firebox, width, in.	102¼
Height, mud ring to crown sheet, back, in.	
Height, mud ring to crown sheet, front, in.	
Boiler Continued:	
Combustion chamber length, in.	72
Arch tubes, number and diameter, in.	4—
Thermic syphons, number	3
Tubes, number and diameter, in.	70—2¼
Flues, number and diameter, in.	178—4
Length over tube sheets, ft.-in.	21—0
Net gas area through tubes and flues, sq. ft.	10.9
Fuel	Coal
Grate area, sq. ft.	106
Heating surfaces, sq. ft.:	
Firebox and comb. chamber	423
Arch tubes	17
Thermic syphons	119
Firebox, total	559
Tubes and flues	4,747
Evaporative, total	5,306
Superheater	2,200
Combined evap. and superheat.	7,506
Tender:	
Style	Rectangular
Water capacity, U. S. gal.	19,350
Fuel capacity, tons	20
Trucks	six-wheel
Journals, diameter and length ,in.	6½x12
General data, estimated:	
Rated tractive force, engine 85 per cent, lb.	67,200
Rated tractive force, booster	None
Weight proportions:	
Weight on drivers ÷ weight, engine, per cent	5.6
Weight on drivers ÷ tractive force	41.7
Weight of engine ÷ evaporation	52.8
Weight of engine ÷ comb. heat surface	37.3
Boiler proportions:	
Firebox heat. surf. per cent comb. heat. surf.	7.4
Tube-flue heat. surf. per cent comb. heat. surf.	63.2
Superheat. surface per cent comb. heat. surf.	29.3
Firebox heat. surf. ÷ grate area	5.27
Tube-flue heat. surf. ÷ grate area	44.78
Superheat. surface ÷ grate area	20.8
Comb. heat. surface ÷ grate area	70.8
Gas area, tubes-flues ÷ grate area	0.10
Evaporation ÷ grate area	50.1
Tractive force ÷ grate area	634.0
Tractive force ÷ evaporation	12.7
Tractive force ÷ comb. heat. surf.	8.95
Tractive force × diameter drivers ÷ comb. heat. surf.	653.6

carbon steel axles and 36-in. rolled steel wheels. The driving wheels have Boxpok cast-steel centers 66 in. in diameter. The driving wheel centers are mounted on carbon steel axles and are fitted with 73-in. tires. The front driver is equipped with the Alco lateral motion device. The main wheels of these locomotives are cross counterbalanced and in balancing the locomotives 28 per cent of a total of 2,024 lb. of reciprocating parts is compensated for. The total amount of reciprocating weights balanced at the main wheel is 100 lb. with 150 lb. balance on the front, intermediate and back wheels.

The trailing truck is the General Steel Castings Corporation's design with 36-in. rolled steel wheels on the front trailing truck axle and 42-in. steel tired wheels with cast-steel centers on the rear axle. All of the axles of the locomotive are equipped with Timken roller bearings.

Hollow bored crank pins are used on the driving wheels. The rods are designed with floating bushings at the main crank pin and are designed for the reboring and application of fixed bushings if desired. The piston heads are of cast steel with carbon steel piston rods and multiple bearing crossheads. The valve gear is of the Walschaerts type actuated by the Alco Type G power reverse gear. The 14-in. piston valves have a maximum travel of 7 in.

The spring rigging is the conventional type, with continuous equalization, on each side, from the front of the front driver to the rear of the rear trailer wheel.

Mechanical lubrication is supplied by means of two Edna Model A 30-pint lubricators. One of these units, having eight feeds, is located on the right side and serves the cylinders, valves, stoker engine and feedwater pump. The other, a 10-feed unit, located on the left side, serves the valve stem guides, engine truck pedestals and center plate, driving and trailer pedestals, furnace bearer, radial buffers, reverse link trunnions and blocks and lateral motion device. Alemite lubrication is used on the rods, motion work, crosshead pins and spring rigging.

The cabs of these locomotives are wood-lined steel, with steel sash and shatter-proof glass. The locomotives are equipped with 30 cu. ft. sand boxes and King type sanders. The brake equipment is the Westinghouse No. 8 ET and air is supplied by two 8½-in. cross-compound air compressors.

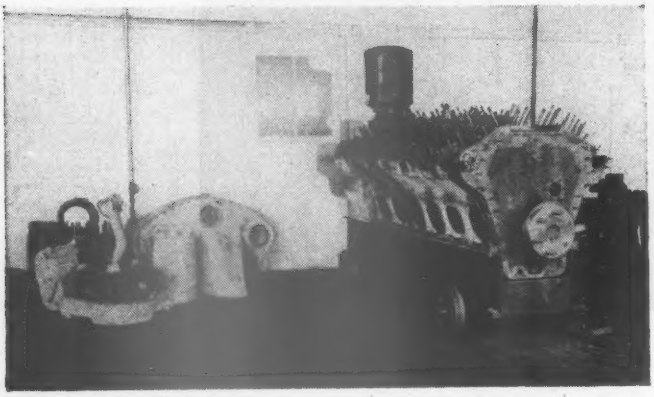
The tenders are the rectangular design with capacity for 20 tons of coal and 20,000 gal. of water. Cast-steel water bottom tender underframes are used and the entire tender tank construction is supported on two General Steel Castings Corporation's six-wheel center bearing equalized tender trucks, having carbon-steel axles and 36-in. rolled steel wheels. The axles have 6½-in. by 11-in. journals and are mounted in SKF roller bearing units.

Partial List of Materials and Equipment on the Missouri Pacific 4-8-4 Locomotives

Engine bed; back cylinder heads; cradle; engine truck; trailing truck	General Steel Castings Corp., Eddystone, Pa.
Wheels-engine truck, trailing truck; axles-engine truck, trailing truck; driving-truck; tires-driving and trailing; crank pins; side and main rods; crosshead guides	Standard Steel Works Division of the Baldwin Locomotive Works, Eddystone, Pa.
Lateral motion device; power reverse gear, slid guide attachment	American Locomotive Co., New York.
Pilot uncoupling rigging	Imperial Brass Mfg. Co., Chicago.
Driving-box roller bearings; engine and trailer-box roller bearings	The Timken Roller Bearing Co., Canton, Ohio.
Coupler pilot	National Malleable and Steel Castings Co., Cleveland, Ohio.
Draft gear yokes	American Steel Foundries, Chicago.
Radial buffer	Franklin Railway Supply Co., Inc., New York.
Foundation brake	American Brake Div., Westinghouse Air Brake Co., Wilmerding, Pa.
Operating brake-locomotive and tender	Westinghouse Air Brake Co., Wilmerding, Pa.
Brake shoes	American Brake Shoe Company, New York.
Cylinder packing rings; piston heads	Locomotive Finished Material Co., Atchison, Kans.
Cylinder and valve bushings	Hunt-Spiller Manufacturing Corporation. Boston, Mass.
Cylinder cocks	The Prime Manufacturing Co., Milwaukee, Wis.
Piston rod packing	Paxton-Mitchell Co., Omaha, Neb.
Spring rigging bushings	Ex-Cell-O Corporation, Detroit, Mich.
Mechanical lubricators	Edna Brass Mfg. Co., Cincinnati, Ohio.
Air pump lubricators	U. S. Metallic Packing Co., Philadelphia, Pa.
Grease fittings	Alemite Div., Stewart-Warner Corp., Chicago.
Plugs-syphon, arch tube and washout	Huron Mfg. Co., Detroit, Mich.
Brick Arch	American Arch Co., Inc., New York.
Flexible staybolts	Flannery Bolt Co., Bridgeville, Pa.
Superheater	The Superheater Company, New York.
Syphons	Locomotive Firebox Co., Chicago.
Throttle	American Throttle Co., New York.
Smokebox hinges; blowoff cocks and muffler; hose strainers	The Okadee Company, Chicago.
Smokebox gaskets	Union Asbestos & Rubber Co., Chicago.
Pipe covering; lagging	Johns-Manville Sales Corp., New York.
Feedwater heater	Worthington Pump and Machinery Corp., Harrison, N. J.
Injectors; boiler checks	Edna Brass Mfg. Co., Cincinnati, Ohio.
Boiler flues; tubes	National Tube Co., Pittsburgh, Pa. Pittsburgh Steel Co., Pittsburgh, Pa. Tubular Alloy Steel Corp., Gary, Ind.
Blower connection	Barco Manufacturing Co., Chicago.
Stoker	Standard Stoker Co., Inc., New York.
Firedoor; grate shakers	Franklin Railway Supply Co., Inc., New York.
Coal sprinkler	Edna Brass Mfg. Co., Cincinnati, Ohio.
Grates	Waugh Equipment Co., New York.
Cab sash	O. M. Edwards, Inc., Syracuse, N. Y.
Cab side ventilators; cab windshields; clear-vision window; water column; drifting valve; cab curtains	The Prime Manufacturing Co., Milwaukee, Wis.
Valves, globe and angle; blower	The Lunkenheimer Company, Cincinnati, Ohio.
Gages-back-pressure, steam; whistle	Locomotive Equipment Division of Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Water gage	Talmadge Mfg. Co., Cleveland, Ohio.
Low-water alarm	Barco Manufacturing Co., Chicago.
Whistle operating valve; bell ringer	Viloco Railway Equipment o., Chicago.
Sanders	U. S. Metallic Packing Co., Philadelphia, Pa.
Headlight; back-up lamps; headlight generator; cab lamps; class lamps	The Pyle-National Company, Chicago.
Flexible connections between engine and tender	Barco Manufacturing Co., Chicago.
Tender:	
Frame; tender truck	General Steel Castings Corp., Eddystone, Pa.
Wheels	Bethlehem Steel Co., Bethlehem, Pa.
Tank cock	Edna Brass Mfg. Co., Cincinnati, Ohio.
Tank strainer	The Okadee Company, Chicago.
Truck boxes; coupler; uncoupling rigging	National Malleable and Steel Castings Co., Cleveland, Ohio.
Truck bearings	SKF Industries, Philadelphia, Pa.
Side bearings	A. Stucki Co., Pittsburgh, Pa.
Draft gear	W. H. Miner, Inc., Chicago.
Radial buffer	Franklin Railway Supply Co., Inc., New York.

B. & O. Repairs

Diesels in Back Shop

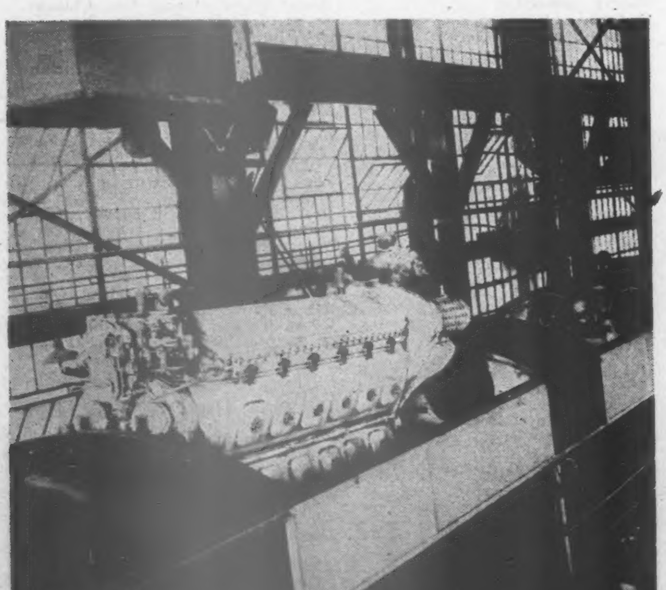


One of the extra engines which are always available—Other spare parts are also kept on hand to speed release of units from the shop

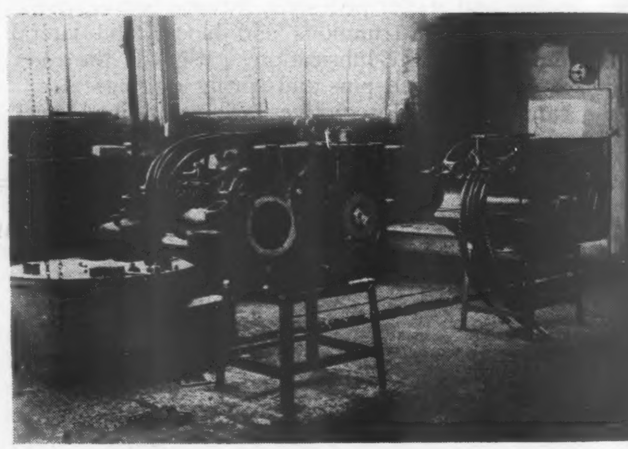
Passenger and freight Diesel-electric locomotives on regular shopping schedule through Mt. Clare back shop—Work done in regular shop routine by employees also engaged in making repairs to steam locomotives

While recognizing that the ideal arrangement for heavy maintenance work on Diesel-electric locomotives is in a shop devoted only to such repairs, it has been necessary for most roads to adapt existing facilities for the purpose. In the case of the Baltimore & Ohio, this has involved the making of heavy repairs to both freight and passenger Diesel-electric locomotives at the Mt. Clare back shop in Baltimore, Md. Anticipating that, as the ownership of this type of equipment increases, construction of independent shop facilities will probably be necessary, this road is studying those now in use as a guide in future planning. The existing arrangements are not of a make-shift character but, in the thinking of the mechanical-department officers, they do not represent shop engineering such as will be involved in laying out and equipping a repair point for the handling of Diesel-electric power exclusively.

A bay off the erecting shop floor has been enclosed and is used for the overhaul of the engines of Diesel units undergoing repairs. All work on the cabs and running gear is done by the shop forces also engaged in making repairs to steam power and is done on the erecting shop floor. The mechanics on engine work are specially assigned from among the regular craftsmen. Required repairs to or overhauling of traction motors, generators and other electrical equipment is done by the personnel of the electrical department in the backshop.



Engines are removed and replaced with an overhead crane

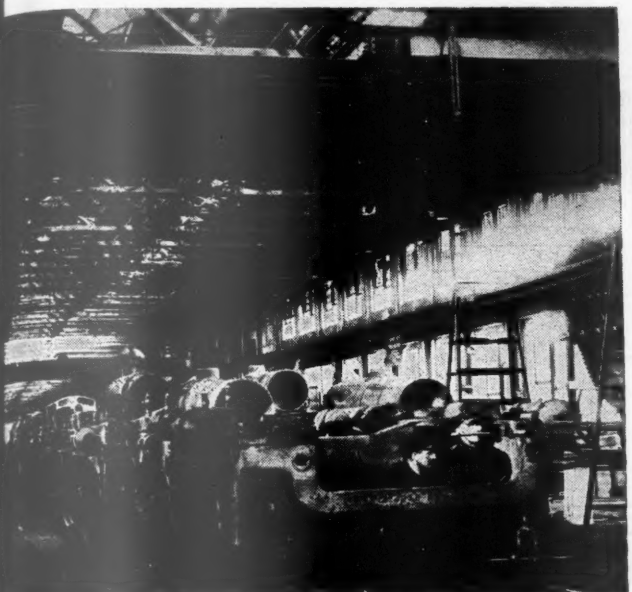


Traction motors are overhauled in the electric shop

Spare Parts Shorten Time in the Shop

Advantage is taken of the interchangeability of parts in Diesel-electric locomotives with the result that the time in shop for repairs has been held to a minimum by the use of spare parts and assemblies which are always kept available. Among these are two complete Diesel engines of 900-hp. for 3,600-hp. locomotives, and two 1,000-hp. engines for 4,000-hp. locomotives. The latter two engines can also be used in certain of the 1,000-hp. switchers owned by the railroad. Extra traction motors, generators, compressors, blowers, radiators and trucks complete the list of major items which are available for immediate use when a Diesel unit is shopped.

When a locomotive unit is received at Mt. Clare it is first run into a crane bay where the engines are removed

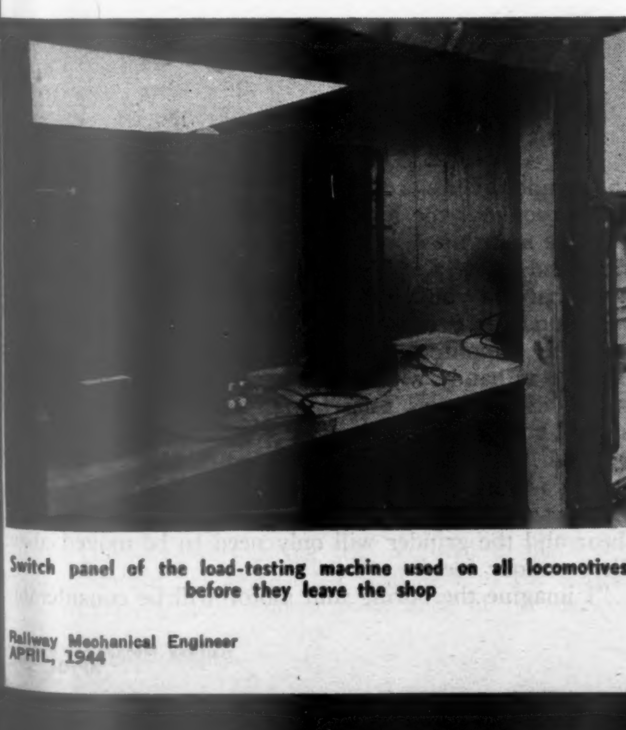


Trucks are worked on the erecting shop floor while the wheels are being turned

and placed on specially designed carriages which are moved to the engine-repair shop and on which they remain during the dismantling and rebuilding periods. The locomotive is then moved to the erecting floor.

The engines are completely stripped and then cleaned in a hot cleaning vat after which the repair and re-assembly operations are begun. Work in the engine repair shop proceeds while the trucks are being worked on the erecting floor. Wheels are turned while the trucks are being overhauled. Necessary repairs to the superstructures, wiring, piping, brake system and other appurtenances are also made at the same time.

Cylinder liners when removed from the engine are all honed on a specially designed machine. Other work in connection with the dismantling and re-assembly of the engine is speeded by the use of tool and parts carts, a piston rack on wheels, and a system of segregating parts requiring repairs from those available for re-application after cleaning. In addition, small spare parts, bolts, screws, nuts, cotters, etc., are stored in sliding metal drawers in a wall rack located near the working spot according to catalogue numbers, names or sizes.



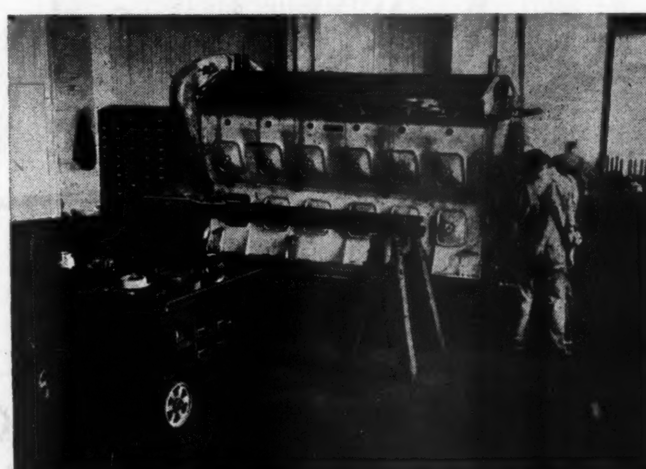
Switch panel of the load-testing machine used on all locomotives before they leave the shop

One mechanical difficulty which was encountered occurred in connection with the lining up of main bearing supports to be certain that they were properly in place and provided correct crankshaft clearance. The nature of these parts is such that they can be applied backward and then will not line up properly. The trouble was overcome by the use of a piece of tubing on which a sliding mandrel was mounted which, when passed through the crankshaft opening, made it possible to detect any improper alignment.

Electrical Repairs and Testing

Whenever a Diesel unit is received at the shop all generators, auxiliary generators, and traction motors are given a complete overhauling. The electrical shop is equipped to do all but the heaviest work on traction-motor armatures and, when any such work is required, the parts are returned to the manufacturer for overhauling on a repair and return basis. The amount of work of this nature is not sufficiently large, at least at the present time, to justify the installation of the facilities required. This is another of the conditions which may change as the ownership of Diesel-electric locomotives grows larger and the volume of repair work increases.

No locomotive leaves the shop before it has received a complete test to determine that the engines will develop their rated horsepower. This testing is done with a load

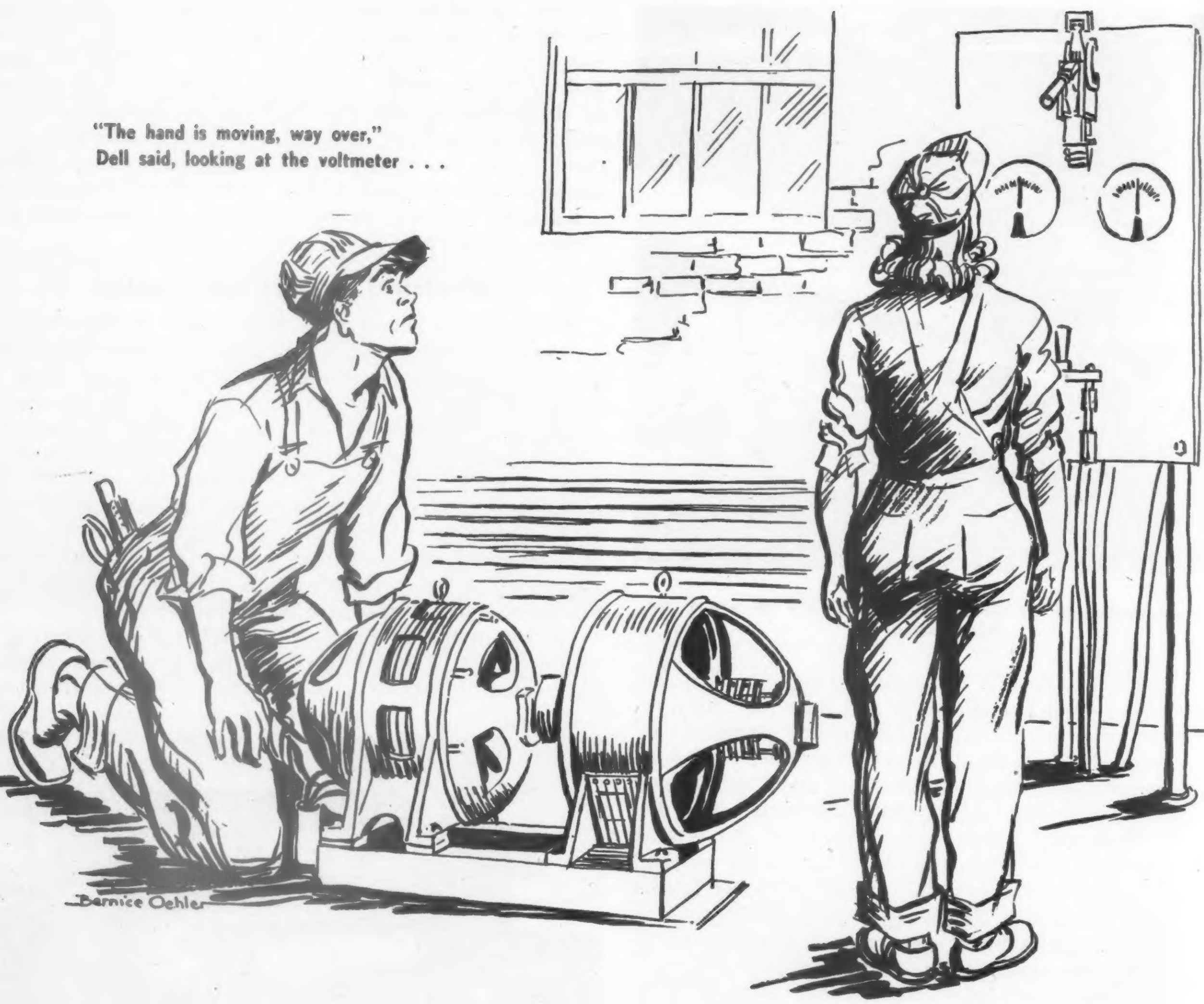


Engines are overhauled in a separate section of the shop—The drawers in the wall cabinet in the background contain the various small parts required by the workmen

testing machine, furnished by the General Electric Company, which is mounted on a rail car for easy movement about the shop property. The machine consists of 72 small resistors and cooling fans assembled and connected to seven knife-blade switches in such a manner that six different values of total resistance can be obtained. For each resistance there are a sufficient number of resistance units in parallel to provide a correct capacity suitable for testing engines rated up to 1,350 hp.

To use the resistor it is necessary to disconnect the two main leads from the locomotive circuit and to run a cable from the generator to the loading resistor. The engine is started in the usual manner. The resistor switches are then thrown for any desired value and the locomotive throttle opened to its full position. Readings are taken of the voltage and current to determine the horsepower rating. Although it is possible to set up maximum resistances and test a newly repaired engine for its rated capacity at the outset, the actual procedure is to run in

(*Continued on page 163*)



"The hand is moving, way over," Dell said, looking at the voltmeter . . .

D.C. SPELLS TROUBLE

by Walt Wyre

If rod bushings and crown brasses came in cans machined ready to serve, machinists in the S. P. & W. Roundhouse at Plainville wouldn't spend as much time as they do waiting for machine work, and Jim Evans, the roundhouse foreman, would have one less worry to wrinkle his corrugated forehead. A few more machines with competent men to operate them would help a lot and Evans has been trying to get both for several months. One day he rushed into the electric shop beaming so that Ned Sparks expected Evans to pass around cigars, but it wasn't a "blessed event" that had Jim Evans beaming. He had just received a wire that a boring mill had been removed from another shop and was on the way to Plainville.

"How long will it take to get it connected up?" Evans asked after he had explained about the boring mill.

"That depends," Sparks replied. "Where do you want to set it and what size is the motor?"

"Well," Evans studied a moment, "the machine shop is pretty well crowded. I believe it would be a good idea to move the punch and shear to the boiler shed, then move the grinder over closer to the row of lathes. That would make room for the boring mill."

"One more move should make the king row," Sparks mumbled.

"What did you say?" Evans asked.

"Sounds like considerable work, including a lot of concrete chipping and I don't imagine my new helper is quite as handy with an air hammer as Rosie the Riveter." Sparks was referring to Dell Malone, the red-headed young lady recently assigned as electrician helper.

"Well, I don't know," Evans fumbled in his coat pocket for his cut of horseshoe, "that shouldn't be so much of a job. There are already wires to the punch and shear and the grinder will only need to be moved about three or four feet."

"I imagine the boring mill motor will be considerably

ger than the punch and shear motor," Sparks told ans, "and that the three No. 12 wires and half-inch nduit would be too small for the boring mill motor."

"Well, anyway, that's the best we can do," Evans said. You might as well disconnect the punch and shear otor right away and I'll have it moved to the boiler ed and you can get it connected up. The boring mill ould be here in about three or four days." Evans left e electric shop.

HERE are your brushes." Dell Malone had been to e storeroom while Evans and Sparks were discussing e boring mill, et cetera.

"Lay them on the work bench," Sparks said as he cked up pliers and screwdrivers.

"Where are you going and what do you want me to do hile you are gone?" Dell asked.

"Get some solvent and tetrachloride and clean that otor." Sparks pointed to the parts of a disassembled 5-horsepower slip ring motor that lay on the floor.

"Here goes my nail polish," Dell remarked as Sparks ft the shop.

Three days later the roundhouse foreman again came to the electric shop. The redheaded helper, wearing blank expression that didn't fit her face as well as the overalls fitted her body, was alone in the shop.

"Where's Sparks?" Evans asked.

"He's in the machine shop wiring up the grinder," Dell eplied. "He sent me to get a hickey. Do you think he as kidding, like the other day when I went to the storeoom and asked for a kilowatt key to turn on the power?"

"No, he wasn't kidding this time," Evans explained, but never mind the hickey. Go tell Sparks to come to he storeroom."

The electrician found the foreman waiting on the storeoom platform beside a box car. "The boring mill hould be in this car," Evans said. "Get a bar from the toreroom and let's open the door and take a look."

"Looks like lots of machinery for one boring mill," Evans remarked when the box car door was open.

"Well, I'll be damned!" Sparks exclaimed.

"What's the matter?" Evans somewhat puzzled inquired.

"It's a d.c. motor," Sparks told him, "and it'll take a week at least to do all that wiring even if everything goes well."

"Haven't we got an a.c. motor that could be used?" Evans asked.

"Even if we had one we couldn't use it," Sparks explained. "There would be no way of regulating the speed of the boring mill."

"Where are you going to get d.c. current?" Evans asked.

"That's what this motor generator set is for." Sparks pointed towards the crated machine. "You see, an a.c. motor runs the d.c. generator which furnished current to operate the boring mill motor."

"Sounds pretty complicated," Evans observed. "Here's something else—looks like a drill press . . . that's what it is, a small drill press! Wonder if it's d.c., too."

Sparks walked over and pulled a couple of boards from the crate. "Yes, it's d.c., too. Guess they couldn't use it after they got rid of the motor generator."

"Well, we can use it." Evans turned to leave. "I'll send the portable crane and some men to help unload this stuff. I'd like to get the machines going soon as possible," he added.

After considerable figuring they decided to place the motor generator set against the wall back of the boring mill. Sparks argued against it because of the danger of metal chips getting into the motor generator, but there really wasn't any other place available to set it. Evans said he would have a screen built to protect the motor generator set and Sparks started to work running the wiring, while his helper divided her time between cleaning the electrical equipment and assisting Sparks.

The job of installing the motor generator would have been finished next day, but the superintendent's chief clerk called right after eight o'clock wanting an electrician to rush right over and repair the thermostatic control for the office heater. "It's hot as blazes in my office; I've turned the thermostat all the way down and the fire is still going," he said.

Sparks swore a little, gathered up a few tools and headed for the office building.

The heater boiler located in the basement uses oil for fuel, natural gas being used for a pilot flame to ignite the oil. The one and only thermostat in the building has at various times been located almost every place in the building until finally the chief clerk had it placed in his office where it had stayed.

The fire was going full blast when Sparks went down into the basement. He pulled the control switch which stopped the oil atomizer motor and caused the magnetic oil valve to close. He then started searching for the trouble. Examination of the thermostat showed that it was operating perfectly. In fact, the contacts were open when Sparks looked at it to be certain, though he disconnected the wires from the thermostat, then went to the basement and closed the control switch. The motor immediately started and the oil valve opened. When he disconnected the thermostat wires from the control panel, the motor stopped and the fire went out, showing that the wires from the thermostat were shorted somewhere.

Sparks went back to the roundhouse and got a magneto ringer to use for locating the short. Dell went with him to do the ringing for him. After cutting the wire in three places and testing, Sparks learned that the wires were shorted in the yard office, which is located in the northwest corner of the building on the first floor. The thermostat had been located there at one time, but being normally the coldest room in the building, they kept it too warm for all of the others.

When the wires were cut at the ceiling and floor of the yard office, the short was cleared above and below. He traced the wires, but could see no sign of a place where they were together. He finally decided to remove the section of wire with the short in it and replace it with some new. Dell went to the storeroom for the wire. While she was gone, Sparks pulled the old piece of wire down, then he discovered the short. Some one in the yard office at night had evidently decided the thermostat in the chief clerk's office was set too low and had decided to do something about it. The insulation had been removed from both wires for a little space, one wire laid on top of the other, and an insulated staple held the bare wires together and covered the bare place. When the wires were taped, the short was clear.

ABOUT noon the next day, Sparks pushed the control button and started the motor generator motor. It ran nicely but a voltmeter test indicated less than ten volts from the generator. After examining field connections, checking brush spring tension, and dressing the commutator, he disconnected the generator and took it to the electric shop and disassembled it. By every test the generator was O. K. After giving it a good cleaning he put it back together and took it back to the machine shop and connected it again. It acted the same as before.

"Maybe it's running backwards," the redheaded helper suggested.

"No," Sparks said somewhat shortly, "it's running the way the brushes slant."

Having tried almost everything else, Sparks ran some wires from an electric welder and connected them to the generator field. The voltage built up and held as long as the welder leads were connected, but wouldn't come up without them.

"I still think it's running backwards," Dell persisted. "Can you make it run the other way?"

"Yes, I can make it run the other way," Sparks replied with more than a touch of caustic in his voice, "and if it will please you, I'll reverse it."

Sparks switched two of the three-phase wires to the motor and started it. "The hand is moving, way over," Dell said, looking at the voltmeter.

Sparks glanced at the voltmeter. It showed nearly 230 volts. He swore under his breath and went outside to smoke and cool off.

"How long will it take now to get the boring mill connected up?" Evans wanted to know when the motor generator was going.

"Oh, it'll take three or four days," Sparks told him, "unless I have some more trouble."

"Well, how long would it take to connect the drill press?"

"About a day. I could run an extension cord to it temporarily," Sparks suggested. "That wouldn't take long."

Evans liked the idea because it could be done quickly. In less than an hour the temporary connection was made to the drill press and Evans was having lots of fun playing with the machine. He was like a kid at Christmas with a mechanical toy.

He moved the rheostat handle back and forth and watched the speed vary. "Thats sure slick!" Evans said. "No belts to shift and you can change speed as little or much as you like just by moving the handle. Sure will be swell if the boring mill operates that good. Get it going as soon as you can. We sure do need it."

In the distant past, Sparks had installed d.c. motors of various types, but in recent years his knowledge of them had rusted slightly for lack of use. He looked in vain among the various articles that accompanied the boring mill for some sort of print of the wiring, hoping more than expecting to find one. The nearest he came to finding a print was some glue stains and a patch of paper about the size of a postage stamp inside the cover of the controller. Sparks scratched his head and dug up the fact that increasing the armature current or decreasing the field current would cause a d.c. motor to increase speed and vice versa. With that and a pile of crooked conduit that didn't seem to fit anywhere and a lot of wire in pieces too short to use, Sparks went to work.

Evans came by often while Sparks was wiring the boring mill motor. He pretended other reasons for passing, but always slowed down and looked over where Sparks, assisted more or less by Dell, was working.

At last Sparks had all of the conduit run, wires pulled in and connected in the right places, he hoped. At least every connection had a wire and there were no odd ends of wire left over. When everyone else in the machine shop was busy, Sparks told his helper to go to the storeroom and get a roll of tape that he didn't need.

"Here's tape." Dell picked up a roll from the tool box.

"I want rubber tape," Sparks said.

"And here's some rubber tape." The redheaded girl made a motion to pick it up. "If you're trying to get rid of me because you are afraid that thing won't run, you needn't bother. It's my job, too, even if it's wrong."

"O. K.," Sparks grinned dryly. "Stand back while I close the switch." Sparks closed the switch, then moved the controller handle to starting position. The motor started. As the handle was moved, the motor increased speed.

"It works!" Dell said with relief.

Jim Evans happened to be passing the machine shop door at the moment, looked in and saw the boring mill running. He turned and walked rapidly to the machine. "Seems to be O. K.," Evans commented. "I'll have a machinist set up a driving box on it and see how it works."

"Well, I'll be back later and see how it's doing." Sparks started gathering up his tools.

It was about three o'clock in the afternoon when Sparks finished the boring mill. At three-twenty-five, the machinist who was operating it came to the electric shop and asked Sparks to come look at the machine.

"What seems to be ailing it?" Sparks asked.

"Hasn't got enough pep," the machinist said. "When I try to take a heavy cut, it slows down."

"Maybe the voltage from the motor generator set is low," Sparks suggested. "I'll test it."

The voltmeter showed about 216 volts when the boring mill was running. Sparks moved the field rheostat a couple of notches. The voltage increased to about 22[illegible] volts. "How's that?" Sparks asked the machinist.

"Seems a little better, but it still slows down and moving the handle don't seem to change the speed as much as it should. It's too fast for low speed and too slow for high speed," the machinist told Sparks.

"Maybe it'll be O. K. when you get used to it," Sparks said hopefully.

The boring mill ran after a fashion for three days, but Evans was disappointed at the results. The foreman agreed with Sparks that it was old, out-of-date, and worn-out, which was probably the reason it was sent to Plainville. When it refused to run at all on the third day after it was installed Sparks decided maybe there was something wrong with the wiring. He found an open connection in the rheostat had caused the motor to quit. He repaired the open by placing a jumper around the resistance coil and the motor ran as before, maybe a little better, if any different.

That afternoon Sparks was at the east fuel oil crane digging literally knee-deep in a double-barreled mess. A new hostler had pulled the old stunt of moving a locomotive with the oil crane spout still in the tank manhole. It worked as usual. The oil crane was pulled over and switch wire and conduit went with it. Sparks had enough oil on his clothes and person to start a refinery when the machinist found him.

"The boring mill has quit again."

"It will probably be in the morning before I get a chance to look at it," Sparks said. "The foreman said for me to stay and finish putting the wiring and switch on the oil crane when the water service men get it repaired. That will probably take until six o'clock."

About five-thirty Evans came up to the oil crane to see how work was progressing on it. "How long will it take to finish?" he asked.

"About another hour," Sparks told him. "I've got the wires in the conduit ready to put on soon as the water service men finish and they are just about through."

"Well, maybe when you get done here you had better go get something to eat and come back and work on the

(*Continued on page 160*)

he Effect of the War On

Passenger Car Developments*

By E. D. Campbell†

Materials developed during the war years may find much broader application in the postwar period—Improvements contributing to more passenger comfort expected

HERE is a place for all of the materials previously entioned, in passenger cars. Here the element of cost not so vital and the features stressed are light weight, mfort, riding qualities of the trucks and travel conniences of many kinds.

In design, however, discretion must be used inasmuch s strength requirements for safety are mandatory. No rbuilder would ever design any passenger car not fully eeting the A. A. R. requirements for strength. Therere, the main structural members of a passenger car are nfined to the steels and the alloys of aluminum. The eel family includes, of course, carbon steels, alloy eels, stainless steels and variations of these. Aluminum n only be used for strength members when alloyed and re the alloy must be selected with the required charteristics.

The interior finish, which has no bearing on the rength of the shell, can be any one of many materials. ere plastics will come into use for interior trim and xtures. Aluminum will also play a prominent part, rticularly since it is a factor in weight reduction. Plyood and Plymetal with different compositions of wood, ve and will continue to be used for doors, partitions and her interior equipment.

The Question of Weight and Trucks

Before this war great strides were made in reduction weight in passenger cars. Previous to the depression ars a conventional steel coach weighed as much as 0,000 lb. This same car of equal strength and diensions, but with four-wheel trucks, by the use of eel alloys weighs 112,920 lb. A stainless steel car of actically the same dimensions weighs 114,140 lb. An uminum car of this type weighs 104,060 lb.

Weight reduction in passenger cars will probably not o below the present level. The carbuilders are now epared to offer designs in carbon steel, alloy steel and ainless steel, of welded or riveted construction. Praccally all carbuilders building passenger cars can also ffer a car built of aluminum alloys.

The passenger car is now pretty much standardized s to dimensions both in length and contour and, in my pinion, the designs were in an advanced stage proven y several years service. It is therefore only in the mforts of riding that we can look for things to happen the post-war period—foremost and fundamental in is respect is the requirement for an easy riding truck. The six-wheel passenger truck seems to be a thing f the past and the long wheelbase four-wheel truck has cceeded it. Cars are now running with these fourheel trucks and giving excellent riding qualities. Howver, all four-wheel trucks do not ride easily, and even e best designs ride roughly under certain track conitions and under any track conditions if not properly aintained.

Another necessity for comfortable riding is satisfactory seats. In discussing seats it should be made clear that seats for suburban and city traffic are quite different from the deluxe type of coach seat. This discussion applies only to the deluxe type passenger car in which the seats are spaced farther apart and comfort is desirable. Seats to be comfortable should have upholstery of very good depth, either spring cushion or sponge rubber cushion, and for overnight travel have reclining backs. Probably a development which can be gained in seat is that the seat cushion be changed in respect to its angular position with the back; in other words, when in reclining position approximately the same angle of seat cushion to seat back should be maintained as when one is in a sitting position.

The fluorescent light became quite popular for lighting cars but probably did not reach its full stage of development when passenger car work was suspended. I understand from the lighting people that they are now prepared to offer this light with reasonable assurance that it will give satisfactory service. The deluxe type coach travel, I believe, will demand two things in lighting. The first will be general illumination of the car without any glare and without any bad effect on the eyes. The second requirement will probably be that each individual in the car will have sufficient intensity of light at the reading plane so that one can read comfortably for long periods without any undue eye strain. The latter requirement probably means individual lights over each seat.

It is taken for granted that all deluxe type of travel equipment will be air-conditioned. In thinking of airconditioning one is so apt to consider cooling only. Airconditioning engineers realize that conditioning the air means correct temperature for body comfort with proper relative humidity in the air under all conditions of outside weather. This idea of air-conditioning has been completely developed and is in use in some cars. It is entirely automatic and will properly condition the air on the same trip in weather from zero to one hundred degrees. This is the ideal system and will probably be generally adopted at some time in the future.

I do not believe that the public is completely educated as to the necessity of having fixed sash in air-conditioned cars. This situation has been recognized by some railroads and they provide for it by having one or two windows at each end of the car arranged to slide. The

*This is the second part of the abstract of a paper presented before a eting of the Anthracite Lehigh Section of the American Society of Meanical Engineers at Berwick, Pa., January 28, 1944. The first part of s abstract, pertaining to materials and freight cars, appeared in the rch, 1944, issue, page 113.

†Vice president in charge of engineering, American Car and Foundry Co.

feeling, of course, regarding sash is due to breakdowns in the air-conditioning equipment during exceptionally hot weather, under which conditions the passengers feel depressed. I believe, however, that air-conditioning equipment will be so designed and built that failures during trips will be practically eliminated. The sash in cars now have double panes of glass with the so-called breather arrangement whereby fogging and clouding does not occur between the glass due to differences between outside and inside temperatures. In fixed sash it is easy to obtain absolute tightness in fitting the same into the car.

Power Requirements and Heating

The demand for power for lighting, air-conditioning and other appliances has reached such proportions that a 20-kw. generator is the minimum generally used. The accepted practice is to hang the generator on the underframe of the car and drive it through an attachment on one of the axles. Manifestly, this puts quite a load on the locomotive with trains having 16 to 18 cars. At the present time there is some agitation to have a self-contained power unit in each car. The source of power contemplated and proposed by one manufacturer is a small Diesel directly connected to the generator.

Under the subject of air-conditioning I mentioned that I think the future systems will incorporate heating as well as cooling. At the present time, however, practically all cars are heated by an independent system of steam heat controlled through the air-conditioning switchboard. As you know, this system derives steam from the locomotive and piped through the length of the train. Obviously a train length of 16 or 18 cars involves some problem of obtaining sufficient heat in the rear cars. This is largely overcome by stepping up the pressure and by regulation. Even so I am told that it sometimes requires 15 to 20 minutes after steam is turned on before the rear cars are sufficiently heated for comfort.

The all-weather system I predicted for the future overcomes this difficulty by a different system of heat distribution. In the year-round air-conditioning the air is heated by being blown over heated fin tube coils.

A Popular Type of Car

For the last seven or eight years a type of travel has become very popular for a single overnight run. I am referring to runs of, say, 16 to 26 hours, such as between New York and Chicago, and between the east coast and Florida. These trains have as the major portion of their consist, the so-called sleeper coaches which are equipped with comfortable reclining seats. No extra fares or charges of any nature beyond that of coach travel are demanded by the railroads for such travel and most people, if only spending one night on a train, prefer this means of reaching their destination. Not only on account of its being much less expensive than travel on a train with sleeper accommodations, but for its convenience and shorter lapse of time for their journey. These cars are provided with sufficient toilet necessities for their passenger capacity and are made quite attractive in appearance. Any one who has travelled between New York and Florida knows that seats on such trains must be reserved in advance.

Decorative Treatment

The interior treatment of passenger cars seems to be run in cycles between very plain and highly decorative finish. At the end of the passenger car building period which I believe was April 5, 1942, we had reached the height of artistic treatment and were on the declining side of the cycle. Probably one reason for the highly decorative interiors during the depression years of the 30's was due to a desire on the part of the railroads to attract traffic away from the buses and private automobiles. At that time highly paid interior decorators were employed and rather lavish interior decorative schemes were used. Probably the economics may determine the extent of interior treatment and my guess is that while we will have pleasing interiors, the lavish expenditure of money for artistic effect will pass out. However, the tremendous progress made in the development of materials which can be used in passenger car interiors has been so great that we may see artistic use of these materials. I refer to the use of plastics, aluminum, stainless steel and various resinous wood combinations.

Some Suggestions

Right here I would like to interject a thought that is really an operating matter and not a carbuilder's particular problem. Even though one is assured of up-to-date equipment, coach travel has two outstanding drawbacks. One is the lack of assurance of a seat, especially in these times, and the other is the bother of taking care of luggage. If one could be assured that these two inconveniences are eliminated, travel in modern coaches will be accelerated. It is possible to do these two things and in fact, on a very few trains it is now being accomplished. It is done by the railroads reserving a seat when the ticket is purchased, and providing means whereby baggage is stored in the car and not left to the passenger to take care of by placing at his feet, or if not too large, in the basket racks. Locker space at the end of the car, guarded by the porter, takes care of the luggage. Parcels are usually handled by the individual anyway.

D. C. Spells Trouble

(*Continued from page 158*)

boring mill motor. We have two engines down and another coming in to go over the drop pit day after tomorrow," Evans said.

When Sparks found that the rheostat on the boring mill was burned open again, he had more than a suspicion that something was wrong. He removed the cover from the back of the rheostat and started tracing wires. About eleven o'clock he was ready to give it up as hopeless when he noticed two wires taped together. He removed the tape from the wires and found two terminals bound together with tape. He traced the wires and found they were attached to separate binding posts in the rheostat box. Another wire on each of the posts went to the motor field winding. Then it dawned on Sparks. He had the armature in series with the rheostat; the two wires taped together completed the field circuit. No wonder the rheostat kept burning open. Designed only for shunt field current, it was many times overloaded.

Next morning Sparks came in whistling. Dell, sitting on the work bench, remarked, "Bet you found what was wrong with the boring mill."

"If I knew as much about motors as women know about men, I could start where Edison stopped," Sparks said.

Utilization of Motive Power*

Report of A.R.E.A. committee dealing with the effects of locomotive development on the economics of railway operation shows interesting analysis of time distribution

At the 1943 annual meeting of the American Railway Engineering Association this subcommittee presented an introductory report on the development of modern motive power units and the effects on the economics of railway location and operation. This year's report, abstracted here, is confined primarily to the question of locomotive utilization. The previous report contained the basic statistics and description of the method of developing the statistical analyses used by the sub-committee in preparing its report. To those interested in the detail background material the text of the first report, appearing on page 191 of the 1943 A. R. E. A. proceedings (Volume 44), will be found of interest.

A statement made in the introductory report justifies repetition for it explains that in making use of the statistics of Class I railroads "it is well to remember that the totals cover a big system, consequently in order to show changes of sufficient magnitude to be noticeable on such a large scale, it is necessary to extend the study over a long period of time. When the time is extended it is difficult to avoid the effect of many variable conditions, consequently so-called system statistics are not very satisfactory bases for deductions.

"For these reasons it is generally necessary to make studies of individual bases because in specific instances, relatively greater changes are made in much less time and the results are less affected by variable conditions." The abstract of this year's report follows:

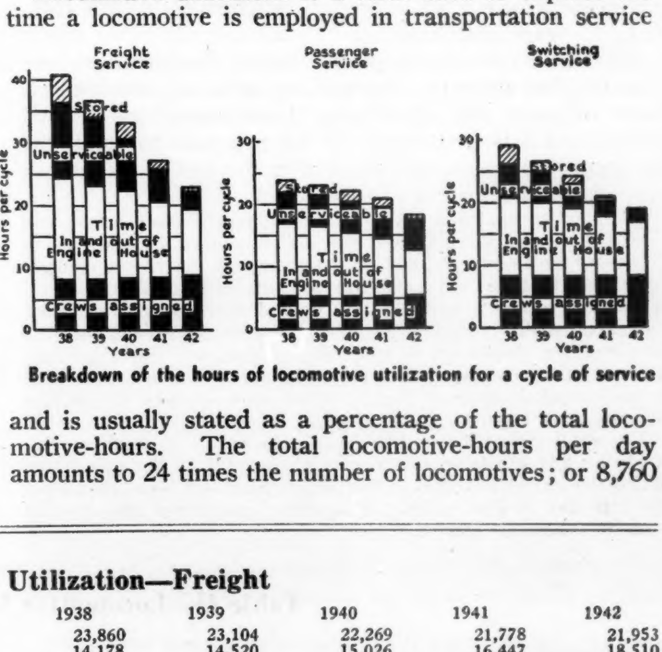
The operating conditions during the period 1938 to 1942 include most of the elements necessary for a preliminary study of locomotive utilization, that is, the operations virtually amount to a series of tests for determining the maximum use that can be obtained from locomotives in various services.

Freight traffic in 1938 was at a low ebb, began to pick up in 1939 and has been increasing continuously ever since without a setback, until it is now about double the volume in 1938.

* Abstract of a sub-committee report on the economics of railway location and operation, A. R. E. A., presented at the annual meeting, Chicago, March 14, 1944.

During this period the number of locomotives has actually decreased notwithstanding the fact that the traffic has practically doubled. In other words, conditions are gradually approaching the stage when locomotives will be subjected to the maximum utilization attainable under existing circumstances. After the present emergency is over these conditions will no longer exist either in kind or degree but the knowledge gained will be extremely valuable for future reference.

Locomotive utilization is a term used to express the time a locomotive is employed in transportation service



Breakdown of the hours of locomotive utilization for a cycle of service

and is usually stated as a percentage of the total locomotive-hours. The total locomotive-hours per day amounts to 24 times the number of locomotives; or 8,760

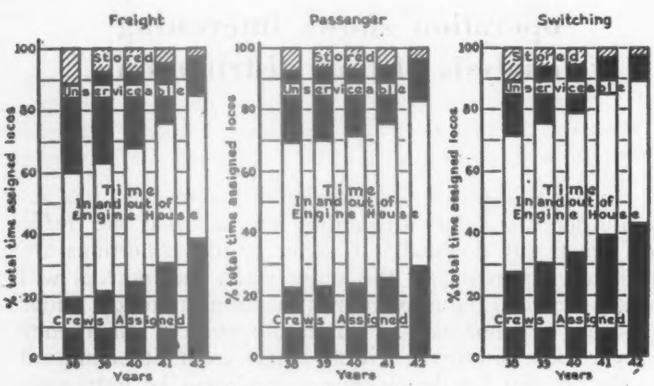
Table I—Locomotive Utilization—Freight

	1938	1939	1940	1941	1942
No. of assigned locomotives	23,860	23,104	22,269	21,778	21,953
No. of serviceable locos. (not stored)	14,178	14,520	15,026	16,447	18,510
No. of serviceable locos. stored	2,682	1,717	1,718	1,058	576
No. of unserviceable locomotives	7,000	6,867	5,525	4,273	2,867
No. of trips (road enginemen)	5,099,493	5,532,488	5,930,539	7,064,954	8,451,497
Locomotive Hours					
Transportation dept. (crew hours)	40,937,856	44,207,834	47,934,076	58,326,725	73,471,573
Time in and out of enginehouse	83,261,424	82,987,366	84,054,308	85,748,995	88,676,027
Sub-total (loco. hrs. serviceable not stored)	124,199,280	127,195,200	131,988,384	144,075,720	162,147,600
Unserviceable	61,320,000	60,154,920	48,531,600	37,431,480	25,114,920
Stored	23,494,320	15,040,920	15,090,912	9,268,080	5,045,760
Total locomotive hours	209,013,600	202,391,040	195,610,896	190,775,280	192,308,280
Average Locomotive Hours Per Trip (Or Cycle)					
Transportation dept. (crew hours)	8.03	7.99	8.08	8.26	8.69
Time in and out of enginehouse	16.33	15.00	14.18	12.13	10.50
Unserviceable	12.02	10.87	8.18	5.30	2.97
Stored	4.61	2.72	2.54	1.31	.59
Total	40.99	36.58	32.98	27.00	22.75
Distribution of Locomotive Hours—Per Cent					
Transportation dept. (crew hours)	19.59	21.84	24.50	30.57	38.21
Time in and out of enginehouse	39.92	41.01	42.92	44.95	46.11
Unserviceable	29.95	29.72	24.86	19.67	13.06
Stored	11.24	7.43	7.72	4.81	2.62
Total	100.00	100.00	100.00	100.00	100.00

times the number of locomotives equals the total locomotive-hours per year.

For purposes of analysis the total locomotive-hours per day, month or year may be divided into a number of parts based upon the data available, for example the following classifications: Locomotive-hours in transportation service; locomotive-hours of serviceable locomotives (not stored); locomotive-hours of serviceable locomotives stored; locomotive-hours of unserviceable locomotives.

The locomotive-hours in transportation service are assumed to be those during which crews are assigned to them. They are therefore equal to the hours that the



Distribution of locomotive hours

engine crews are actually on duty, a figure obtainable from I. C. C. wage statistics.

The locomotive-hours in the other classifications are not compiled directly. Instead, an arbitrary method has been adopted for classifying locomotives as defined below, and it is customary for the railroads to count the locomotives in each classification at the end of the month and report the results to the I. C. C.

Assigned locomotives relate to locomotives owned, leased and rented . . . and should show the assignment of locomotives to classes of service at the end of the month of the report counted according to type and condition as indicated. Stored or unserviceable locomotives should be counted in the service in which they are usually assigned, but retired locomotives held for sale or demolition should not be counted. Locomotives running partly in more than one class of service should be counted according to the preponderance of their time in such services throughout the month of report. . . .

The term stored locomotives means locomotives in serviceable condition and available for service at the end of the month for which the report is rendered and which have not been used since the 15th day of that month; it includes locomotives under white lead or otherwise stored.

The term unserviceable locomotives means locomotives awaiting or undergoing repairs if held more than 24 clock hours on that account and includes unserviceable stored locomotives.

The cumulative figures shown in the yearly statements represent averages of the number of units of equipment reported at the close of each month of the year. The averages are computed for each railway separately and then totaled.

The locomotive-hours shown in the tables, except transportation service, represent the locomotives in each classification multiplied by the hours in a year.

Time Charged to Mechanical Department

The difference between non-stored serviceable locomotive-hours and the hours in transportation service represents the time of active locomotives which is largely taken up by miscellaneous engine house operations—waiting in line at the ash-pits, etc., or on ready track waiting to be called. On account of the latter operation, control of the time in and out of engine house does not rest entirely with the mechanical department because the time on ready tracks depends somewhat upon train schedules which are under the control of the transportation department. But all of the time in and out of engine house has been charged to the mechanical department for simplicity.

As traffic increases the time locomotives are in the hands of the transportation department increases, as shown in the tables, which means the time that is left to the mechanical department decreases as the traffic increases. Also as traffic increases locomotives require more attention, therefore it is necessary for the mechanical department to perform more work as traffic increases. Consequently with the mechanical department the difficulties are cumulative because it is not only necessary to do more work but also to do it in less time.

Naturally a balance will be reached when the time available for doing the work is just sufficient for its performance. Under this condition the time locomotives can be kept in the hands of the transportation department will be a maximum and will depend upon shop and engine house performance.

Shop and Engine House Utilization

Shop and engine house performance, or the time the mechanical department needs to perform the required functions, depends upon the capacity, that is, the adequacy of the layout and the ability of the equipment to function properly. If the mechanical facilities are limited, locomotive utilization may also be limited by reason of this fact. However, if the capacity of the mechanical facilities is more than ample it will still be necessary

Table II—Locomotive Utilization—Passenger

	1938	1939	1940	1941	1942
No. of assigned locomotives	8,002	7,668	7.327	7,106	6,787
No. of serviceable locos. (not stored)	5,515	5,330	5,204	5,342	5,596
No. of serviceable locos. stored	625	506	523	417	235
No. of unserviceable locomotives	1,862	1,832	1,600	1,347	956
No. of trips (road enginemen)	2,964,693	2,930,290	2,932,445	3,018,768	3,277,960
Locomotive Hours					
Transportation dept. (crew hours)	15,740,023	15,334,828	15,254,300	15,593,609	17,404,045
Time in and out of enginehouse	32,571,377	31,355,972	30,457,636	31,202,311	31,616,915
Sub-total (loco. hrs. of serviceable not stored)	48,311,400	46,690,800	45,711,936	46,795,920	49,020,960
Unserviceable	16,311,120	16,048,320	14,054,400	11,799,720	8,374,560
Stored	5,475,000	4,432,560	4,594,032	3,652,920	2,058,600
Total locomotive hours	70,097,520	67,171,680	64,360,368	62,248,560	59,454,120
Average Locomotive Hours Per Trip (Or Cycle)					
Transportation dept. (crew hours)	5.31	5.23	5.22	5.17	5.31
Time in and out of enginehouse	10.99	10.70	10.39	10.33	9.65
Unserviceable	5.50	5.48	4.77	3.91	2.55
Stored	1.84	1.51	1.55	1.21	.63
Total	23.64	22.92	21.95	20.62	18.14
Distribution of Locomotive Hours—Per Cent					
Transportation dept. (crew hours)	22.45	22.83	23.70	25.56	29.27
Time in and out of enginehouse	46.47	46.68	47.33	49.62	53.18
Unserviceable	23.27	23.89	21.83	18.95	14.09
Stored	7.81	6.60	7.14	5.87	3.46
Total	100.00	100.00	100.00	100.00	100.00

Table III—Locomotive Utilization—Switching

	1938	1939	1940	1941	1942
No. of assigned locomotives	12,814	12,756	12,708	13,034	13,359
No. of serviceable locos. (not stored)	9,111	9,585	9,977	11,050	11,889
No. of serviceable locos. stored	1,321	758	670	390	324
No. of unserviceable locomotives	2,382	2,413	2,061	1,594	1,146
No. of trips (road enginemen)	3,861,764	4,225,417	4,603,265	5,489,036	6,210,576
Locomotive Hours					
Transportation dept. (crew hours)	31,016,505	34,053,393	37,205,845	44,686,845	50,557,930
Time in and out of enginehouse	48,796,855	49,911,207	50,432,123	52,111,155	53,589,710
Sub-total (loco. hrs. of serviceable not stored)	79,812,360	83,964,600	87,637,968	96,798,000	104,147,640
Unserviceable	20,866,320	21,137,880	18,103,824	13,963,440	10,038,960
Stored	11,571,960	6,640,080	5,885,280	3,416,400	2,838,240
Total locomotive hours	112,250,640	111,742,560	111,627,072	114,177,840	117,024,840
Average Locomotive Hours Per Trip (Or Cycle)					
Transportation dept. (crew hours)	8.03	8.06	8.08	8.14	8.14
Time in and out of enginehouse	12.64	11.81	10.95	9.49	8.63
Unserviceable	5.40	5.00	3.93	2.55	1.55
Stored	3.00	1.58	1.27	.62	.42
Total	29.07	26.45	24.23	20.80	18.84
Distribution of Locomotive Hours—Per Cent					
Transportation dept. (crew hours)	27.63	30.47	33.33	39.15	43.20
Time in and out of enginehouse	43.47	44.68	45.18	45.63	45.80
Unserviceable	18.59	18.91	16.22	12.23	8.57
Stored	10.31	5.94	5.27	2.99	2.43
Total	100.00	100.00	100.00	100.00	100.00

to keep locomotives out of service part of the time for inspection or overhauling. This time is somewhat affected by the design and accessibility of parts and also by the durability of materials used in modern locomotives.

Therefore in practice the maximum time locomotives can be kept in service depends upon so many variables that it can only be determined experimentally when conditions are suitable, or by experience.

The distinction between freight, passenger and switching locomotives is more or less indefinite, that is, the classification is based on the judgment of individual carriers, whereas the classification of assigned locomotives is based on the preponderance of the service performed by individual locomotives. Thus the distribution of locomotive-hours between the various services will depend upon which classification is selected as a basis but the distribution of the time in service, namely, the crew hours is definite and independent of any classification.

It is doubtful whether the distribution of locomotive-hours between the time in and out of the engine house and the time that locomotives are considered unserviceable has any real significance as regards the time spent in the engine house versus the time spent in the shop. Apparently the time in and out of the engine house increases when the time in transportation service increases, which may be due to the fact that with more locomotives to handle more delays will be encountered or it may be due in part to faults in the method of compiling the data.

The chief reason why it has been possible to obtain more intensive use of locomotives is that they have been kept out of service a smaller proportion of the time due to the fact that the work has been expedited by increasing shop and engine house forces, adding extra shifts, etc., in order to obtain greater use out of shop facilities.

B. & O. Repairs Diesels in Back Shop

(Continued from page 155)

the engine, stepping up the resistance at intervals. A careful study of the current and voltage characteristics is made for each stage and gives a complete picture of performance over the entire operating range. The full-loading stage is carried on for several hours to make certain that the engine will perform at full-rated capacity and that there are no conditions which require correction.

In addition to the regular cycle of back shop repairs, Diesel facilities at the home terminals and turning terminals for this type of road power on the B. & O. are set up to give regularly scheduled partial repairs, especially to wearing parts. For example, pistons, cylinder heads and liners in each road passenger locomotive are removed on a mileage basis between regular runs. The carbon is cleaned, new rings are applied, cylinder liners honed and the valves overhauled and adjusted. Similarly, other parts are periodically inspected and renewed according to a prepared maintenance schedule. Additional work is done when an engineman, inspector or a Diesel-electric supervisor-rider indicates that it is needed. A

Mobile parts carts are very useful and of help in keeping the shop clean and orderly

printed form in the cab of each locomotive shows what work has been performed or is scheduled to be done. In addition there are a number of other record forms kept by foremen, inspectors and supervisors which serve as a case history of the repairs made while each locomotive is in service. This close attention to detail and running maintenance keeps this class of power highly serviceable between shoppings. Records of the road indicate that the 13 two-unit Diesel-electric locomotives in operation average approximately 20,000 miles monthly with an availability rating of about 95.5 per cent. It is expected that, as the program for general overhaulings to Diesel passenger power becomes fully operative, individual units will be shopped after each million miles of service.

EDITORIALS

Invitation Renewed

In the July, 1943, issue of the Railway Mechanical Engineer an editorial entitled, "Watch That Curve Now That Summer Is Here", extended an open invitation to any road which succeeded in flattening out the summer-month, hot-box curve to tell its brother railroads how the job was done. It is now April and no one has accepted our invitation. But, we can still hope that someone who has a story to tell will accept this renewal of the invitation.

Another summer is on the way but there still is time to lay plans for combatting the hot-box rise. The question is, "How shall we plan?". No one who has had success in flattening out the curve has come forward to tell us how it was done. It may be that no road was able to do it and that we must look ahead this year, as in years past, to the trebling, and more, of the wintertime average of cars delayed or set out of trains because of hot boxes. If this is true we are likely to have cause, more than ever, to regret our inability to overcome this perennial problem.

Certainly, journal boxes are allergic to hot weather. We wish that we could help find the doctor who could isolate the causes and, having done so, prescribe the remedies.

Roll-Out Battery Boxes

The suggestion has come from one of our readers that battery boxes on passenger cars should be mounted on rollers so that they could be pulled out from the side of the car like a filing cabinet drawer for servicing and inspection. The first and probably most important advantage of such an arrangement is that it would facilitate flushing, the necessary periodic replacement of water which is lost by battery action. Probably more batteries have been injured by improper flushing than by any other means. It would also mean that less water and electrolyte would be spilled out on top of the batteries to later run down and corrode or rot the battery box. The next advantage afforded by the arrangement would be that the long leads now required between adjacent trays to permit hauling them out of the battery box would not be needed. If the battery could be moved out, shorter connections could be used. This would save cable, reduce damage to leads and permit careful inspection for loose terminals. The arrangement would also reduce damage to trays since it is often necessary to pry them loose with a bar before they can be removed from the box.

The use of the pull-out equipment frame is not new. It is used for engine-driven compressors and engine-driven generators. They are mounted on spring-cushioned wheels and the weight of the largest unit is about 1,650 lb. The weight of batteries is comparable, the largest size used commonly, weighing about 3,800 lb. Such a battery is normally placed in two boxes and each box with its battery would weigh about 2,000 lb. It would appear therefore that such mounting would present no great difficulty and the cushion mounting should serve to protect the battery from shock and vibration.

There are many men in the field sufficiently familiar with car construction and with the requirements of good battery performance to make worthwhile suggestions on the practicability of such battery mounting. Their comments are requested in a question which appears in the Consulting Department of this issue, page 186.

A Study of Coach Seat Dimensions

With the probability that some new railway coaches will be constructed towards the end of this year and possibly a sizeable number in 1945, it is not too early to think about the possibility of standardizing a few fundamental dimensions of coach seats which will assure greater passenger comfort and enable seat manufacturers to get into quantity production on the main frames and operating mechanisms, at least, with attendant advantages to all concerned. The idea is simple to standardize a few of the principal dimensions and interfere in no way with various seat builders improving the design and appearance of their individual products.

Railway officers are taking a definite interest in this subject and, in fact, a joint study is now under way by the seat builders and the Association of American Railroads in conjunction with the Interterritorial Passenger Agents Association. The latter is represented by a committee consisting of J. V. Lanigan, recently retired passenger traffic manager, Illinois Central; J. F. Whittington, district passenger manager, Baltimore & Ohio; J. W. Switzer, passenger traffic manager, New York Central; and E. M. Holt, general passenger agent, Pennsylvania. The A. A. R. Mechanical Division has delegated active work on this project to a Car Construction sub-committee including chairman J. K. Peters, mechanical engineer, Denver & Rio Grande Western; W. A. Pownall, mechanical engineer, Wa-

bash; and L. H. Kueck, assistant chief mechanical officer, Missouri Pacific.

The most important dimensions of coach seats are the height from the floor to the cushion top, front and rear; depth of the cushion; height of the back; and overall dimensions of the seat. With a view to determining as factually as possible which of these dimensions will accommodate the greatest number of people, a study is now being made whereby several thousand people will be measured and average dimensions secured. A measuring chair, supplied by Heywood-Wakefield, one of the seat manufacturers, has been set up at the Boston & Maine Union Station, Boston, Mass. Actual measurements will be taken under the direction of E. A. Hooton, head of the Harvard University department of anthropology which specializes in accurate measurements of human anatomy and has made certain information of this kind available to military authorities as needed.

It is hoped that the findings regarding preferred standard major dimensions for coach seats can be reached promptly and made available to railroads and manufacturers alike, so that seats for the new cars now being planned will conform to improved standards of the future rather than include dimensions used in the past which have too often been based largely on mere guess work in the absence of much-needed exact information.

Welding Not At Fault

Welding has recently come in for much unmerited criticism as a result of the public hearings conducted to study the failures occurring in all-welded merchant vessels. The press has been fair in reporting that engineering design and specifications, haste and, probably, inadequate and sometimes incompetent supervision were at fault. But, to the public, the matter of interest is that these were welded vessels and, unfortunately, welding gets the blame. None of the causes of the breaking up of these ships are inherent in the welding procedures used.

It is doubtful whether any railroad man could be made fearful concerning the extension of welding procedures on motive power or rolling equipment on the basis of the investigations being conducted. They can serve, though, to remind us that established engineering and metallurgical knowledge must be relied upon to determine what can be welded and how the work is to be done. Correctly designed structures, properly welded, do not fail.

Not only must the engineer be considered but also the workman on the job. The June, 1942, welding issue of the *Railway Mechanical Engineer* emphasized in one article the importance of proper training of operators and the supervision and testing needed to insure continued competence. Welding, when applied to work for which it is adapted by skilled operators working according to plans based on proved principles, is one of the most important tools of modern industry. It must be used, as any other tool, with a full understanding of its possibilities and an equal appreciation of its limitations.

Operating Averages Tell Only Part of the Story

In operations of as broad scope as the railroad systems of this entire country, statistical averages dealing with the combined operations rarely reveal sudden changes or outstanding individual performances. In this respect while we are generally familiar with the statistical averages of locomotive utilization pertaining to the Class I roads collectively, we are not too often conscious of the fact that behind these averages, which in themselves reveal the trends, are concealed some amazing individual road and locomotive performances.

This point is well illustrated by a report on the development of modern motive power units and the effects on the economics of railway operation which was presented at the annual meeting of the American Railway Engineering Association at Chicago last month, an abstract of which appears on page 161 of this issue. This report, dealing as it does with the currently interesting subject of locomotive utilization, is presented to the readers of this publication, not for the specific purpose of commenting on the statistics presented with the report but because these statistics, the accompanying charts and the text of the report embody data of exceptional interest to those who are interested in the mechanical department.

The major portion of the report consists of a presentation of the statistics of locomotive utilization, freight, passenger and switching services for the five years 1938 to 1942, inclusive and analyzes the hours of locomotive service, the average hours per trip (or cycle) and a distribution of total locomotive hours on a percentage basis.

Data presented in the report, not included in the abstract, give the statistics of freight train performance for the five years mentioned and the details of the locomotive inventory. As background information for a study of Table I of the report it is interesting to keep in mind that for the year 1942, as compared with 1938 there was an increase of 55 per cent in freight train miles, 90 per cent in gross-ton miles and 65 per cent in the number of trips made by road enginemen. During this same period the report shows that the number of steam locomotives decreased by 3,961, and locomotives ther than steam increased by 1,049, making a net decrease in the total locomotive inventory of 2,912.

The data presented in the three tables in the report are also shown graphically in the accompanying charts. These charts show what has taken place in the relatively short period of five years. Commenting specific-

ally on the data relating to freight service, the report shows that in 1938, 40.99 hours were required to complete a trip, or cycle, of locomotive service whereas in 1942 only 22.75 hours were required for a cycle of service. Obviously, freight locomotives spent more time in the hands of the transportation department and less time in the hands of the mechanical department. In 1938, the figures show that 16.33 hours were taken up from the time the locomotive reached the engine terminal until it left for its next trip, whereas in 1942 only 10.5 hours were involved.

In analyzing the distribution of locomotive hours it is interesting to note that the percentage of time in the hands of the transportation department increased from 19.6 to 38.2 while, in spite of the reduction in the average number of hours spent at terminals, the percentage time increased from 39.9 to 46.1. These are the average figures and their primary value is to show the relation of the overall picture, one year with another, and to show the trend over the period of years under consideration.

The future of the steam locomotive may well rest upon the ability of its proponents to accomplish one major improvement with respect to its utilization. That is, to cut the time required at engine terminals for inspection, servicing and repairs and thereby increase the time available to the transportation department for revenue service. It is in this respect that comment is directed particularly to the average figures shown in the report pertaining to the hours spent at engine terminals.

Regardless of any conditions recognized by the committee in compiling these figures which may affect their accuracy, the data appear to show, above everything else, the tremendous price which the railroads are paying for the necessity of using that large portion of their locomotive inventory which is recognized as obsolete. It is this large group of the older locomovties that is responsible for producing an average figure of time spent at engine terminals as high as that for the year 1942, namely, 10.5 hours per trip. Any mechanical man on a railroad on which there are a number of modern steam locomotives knows that these modern units are being turned at terminals in an average time of not over three to four hours.

Without carrying this discussion into greater detail it is worth while again to point out that statistics such as those developed in this report are valuable primarily as indicators of trends and serve the additional purpose, if viewed in the proper light, of bringing out in bold relief the influence of the older motive power on the general operating picture. It is to be hoped that if the committee continues this study there may eventually be included separate analyses of strictly modern motive power units so that a comparison between the average performance of the inventory as a whole and the modern locomotives may be made without difficulty. Without this, the picture is far from being complete.

NEW BOOKS

PRACTICAL DESIGN OF WELDED STEEL STRUCTURES. *By H. Malcolm Priest. Published by the American Welding Society, New York. 153 pages, 5 in. by 7¾ in.; cloth bound. Price $1.00.*

This concise summary of the essentials of welding and welded construction is intended as a working aid for engineers and fabricators in the preparation and execution of welded designs. It includes brief, yet adequate, discussions of the various welding processes, specifications for electrodes, types of welds, welding positions, qualifications tests and inspection. Weld geometry and stress concentration is discussed at some length and temperature effects, both physical and metallurgical, receive considerable attention.

The Codes of the American Welding Society are dealt with inasmuch as unit stresses from these codes have been widely adopted for most designing in welded construction and form the basis for the numerous charts and tables throughout the book. A section also discusses the subject of fatigue in welded structures.

General and detail design considerations for simple welded joints and connections precede their application to typical structural members. Beam connections are fully treated and considered in the light of continuous structures. A brief section deals with rigid frames. A most useful feature of the book is the inclusion of numerous charts which are helpful in designing of welded joints and structural members. The charts are arranged so as to be applicable for any specified unit working stresses.

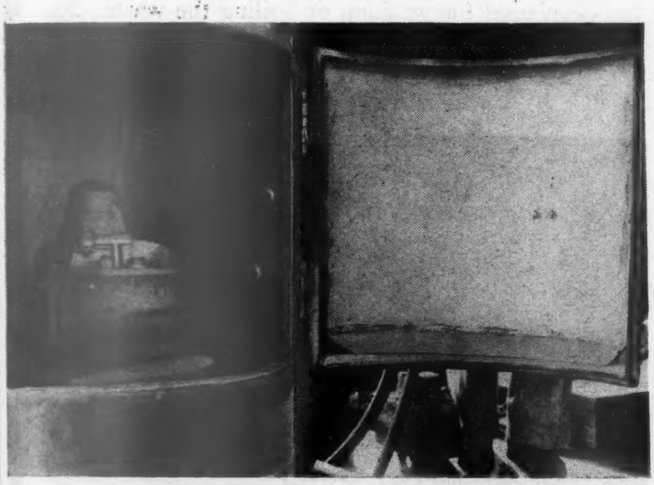
Diesel Locomotives—Electrical Equipment. By John Draney. Published by the American Technical Society, Chicago. 388 pages, 5¼ in. by 8 in. Price $3.75, cloth bound.

This is the second of two books to be brought out by this publisher in which pertinent information relating to several makes of Diesel-electric locomotives has been assembled. The first book by the same author, which deals with mechanical equipment, was reviewed in the January, 1944, issue of *Railway Mechanical Engineer*. The first four chapters of the book on electrical equipment explain the fundamentals of electricity; the fourth chapter describes the principles of electric transmissions for Diesel-electric locomotives, and the last five chapters include specific information on electrical equipment, respectively, for General Electric light-weight Diesel locomotives, Baldwin-Westinghouse switchers; Electro-Motive locomotives, Alco-G.E., 660 and 1,000-hp. locomotives and Alco-G.E. road locomotives. Descriptions of apparatus are supplemented by data on operation and maintenance. The author, who is in charge of the Diesel question and answer department, Brotherhood of Locomotive Firemen and Enginemen's Magazine, was assisted by a staff of ten collaborating authors including educators and representatives of railroads and manufacturers.

With the Car Foremen and Inspectors

Sandblasting Machine for AB Valves

At the Havelock, Neb., car shops of the Chicago, Burlington & Quincy, the sandblasting machine, illustrated, is used for thoroughly cleaning the exterior surfaces of air brake valves, particularly Type AB valves, preliminary to repairing and reconditioning. The alloy covers of the AB valves, especially those used in refrigerator car service, frequently become corroded, and all dirt and



The sandblast machine with the air-tight door open showing an AB valve on the rotating plate

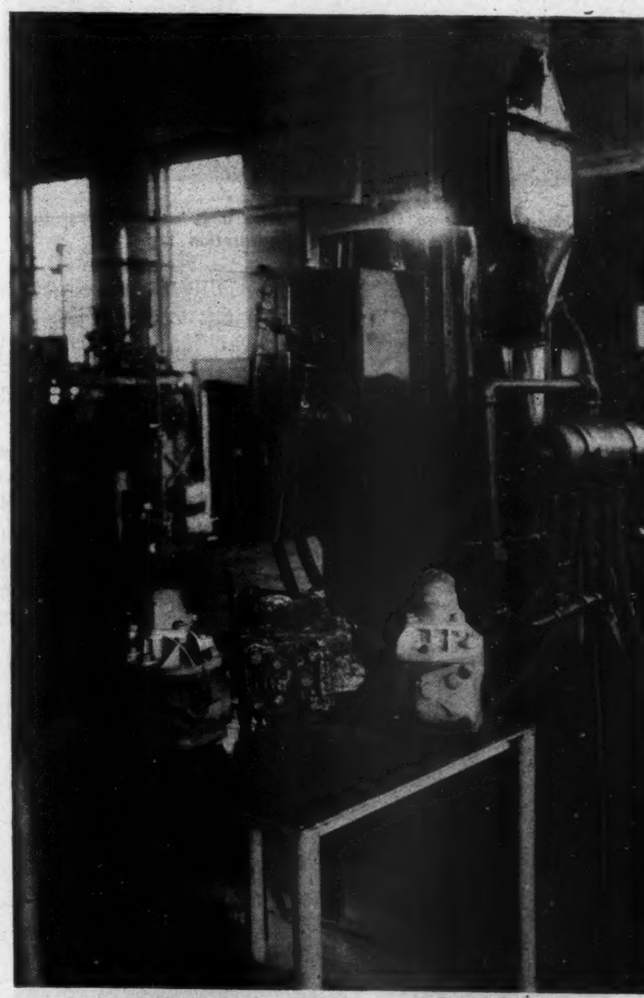
oxidized scale must be removed so that a protective coat of paint can be applied to the clean metal and thus arrest the corrosive action.

The sandblast machine is cylindrical in general shape, roughly 3 ft. in diameter by 6 ft. high. It is made of sheet metal with a 10-in. exhaust stack extending straight up to and through the roof to keep dust out of the shop. The base of the machine is designed to receive the sand as it falls from the sandblasting operation and carry it in storage until required for refilling two rectangular bins, one on each side of the machine near the top. From these bins, sand is syphoned to nozzles which direct jets of air and sand onto the work in the usual manner.

A circular rotating plate, located in the machine at a level of about 3 ft., is driven at reduced speed through bevel gear connection from an air motor at the rear. This plate supports and rotates the AB valves during the sanding operation without the necessity of using any holding clamps. The valves are simply placed on the plate one at a time and, as the plate rotates, each valve is cleaned all over in about one minute.

An easy-opening, air-tight door gives ready access to the rotating plate for quick application, inspection and removal of the valves. This construction is clearly shown in the close-up view which also shows the ends of the two sand-blast nozzles installed on the right side of the machine. On the left side of the machine (as the operator faces it) there are three nozzles. Each of the five sand-blast nozzles is equipped with a valve to control the air flow and may be adjusted slightly to direct the sand against the valve at the most effective angle to give complete coverage. Hose connections to the air manifold at the back of the machine are illustrated. The piping connections are such that all nozzles, also the air motor which rotates the valve-supporting plate, are started and stopped by a single valve at the front of the machine.

The larger illustration which indicates the general construction of the machine also shows on a table in the



AB valves before and after being sandblasted on the machine shown in the background

foreground three AB valves, the one in the center before cleaning and the two outer ones after being cleaned. It is of course highly essential to plug or securely cover all portholes before putting AB valves in the sandblasting machine.

Canadian National Packing Renovating Plants

Within the past several years the Canadian National has centralized its reclamation of used journal box packing and the preparation of new packing at two shops, one at Montreal and the other at Winnipeg. These plants which operate under close controls replace a number of smaller ones formerly scattered over the system and are credited with contributing materially to the reduction in the number of hot boxes occurring on the road. In addition, capital outlay and overhead has been reduced and the closer control over manufacture insures a uniform product. During 1942 the two plants produced 6,986,925 lb. of packing and, in 1943, 8,007,175 lb.

As the dope is removed from the rumbler it is examined carefully before being put into a saturation tank

Used packing is received at these plants in steel drums which are placed upon a tilting device and emptied into round perforated containers. These containers are placed in tanks containing clean oil which is maintained at a temperature of approximately 230 deg. F. After two hours the containers are removed and placed in a centrifuge in which they are rotated for 15 min. at a speed of 750 r.p.m. Excess water and oil removed from the waste in the centrifuge is drained into a storage tank.

When drums of old waste are received they are emptied by means of a pneumatically operated tilting device into perforated containers

The container is then unloaded onto a sorting table where the waste is picked over, foreign material removed, the waste teased if necessary and then introduced into the rumbler which is a perforated revolving screen of $1\frac{13}{16}$ in. square mesh equipped with a series of spikes which shred out the waste. Short ends fall through the mesh and are collected for use in lighting locomotive fires. After rumbling the waste is again loaded in a container and placed in a saturating tank for from three to four hours. After another spinning in the centrifuge, teasing and rumbling it is loaded into clean steel shipping drums. At this point in the process the waste contains about 25 per cent by weight of oil. One hundred pounds of waste is loaded into a drum and 175 lb. of free oil is added. The drum is covered with a special cover fitted with a locking device and a gasket to prevent the entrance of moisture or dirt and the packing is ready for shipment.

All dirty oil coming from the centrifuge or which has been used for washing or boiling the waste, cleaning drums, etc., is carried to a tank which is kept at a temperature of 250 deg. F. to distill off moisture. Hot oil from this tank is then passed through a clarifier which revolves at 1,200 r.p.m. and serves to separate the dirt and sludge from the oil by centrifugal action. When clarified the oil goes to a holding tank from which it is drawn for washing waste and dirty drums. Some of the oil from this holding tank is again clarified and passed to another tank where it is held for 16 hr. at a temperature of 250 deg. F. From here it is pumped to a settling tank where it remains for 72 hr. after which a sample is taken for analysis. The chemist's analysis determines the amount of fuel oil which must be added to obtain the desired viscosity in the reclaimed oil. Oil is pumped from the settling tank to a pair of mixing tanks in which the fuel oil is added. The reclaimed oil and fuel oil are circulated through these two tanks until thoroughly mixed.

A container of waste about to be placed in the centrifuge for the removal of water and excess oil

The oil must meet specifications calling for a viscosity of 200 sec. at 100 deg. F. and not less than 45 sec. at 210 deg. F. A cold test of —35 deg. F. is also made, this being the point at which oil becomes workable after

being frozen solid. A flash point of 345 deg. F. is another of the characteristics for which the oil is tested. These check analyses are made regularly to detect any errors which might occur in the addition of fuel oil.

The paste-like residue removed from the clarifier is used for greasing center plates and other wearing surfaces and for protecting the journals of axles from rusting.

New packing, when required, is made by washing the waste once and teasing twice. However, the practice of making all new dope is avoided as much as possible. The preferred method is to add the required amount of new waste to the old dope to balance losses.

Air Brake Questions and Answers

Installation and Maintenance of Axle Generators

240—*Q.—Where is the lever in electro-pneumatic, HSC operation?* A.—In forward position, nearest the operator, with the letters *S. A.* exposed to view.

241—*Q.—Where is the lever in automatic pneumatic operation?* A.—It is latched in its rear position, farthest from the operator, with the A. U. exposed to view.

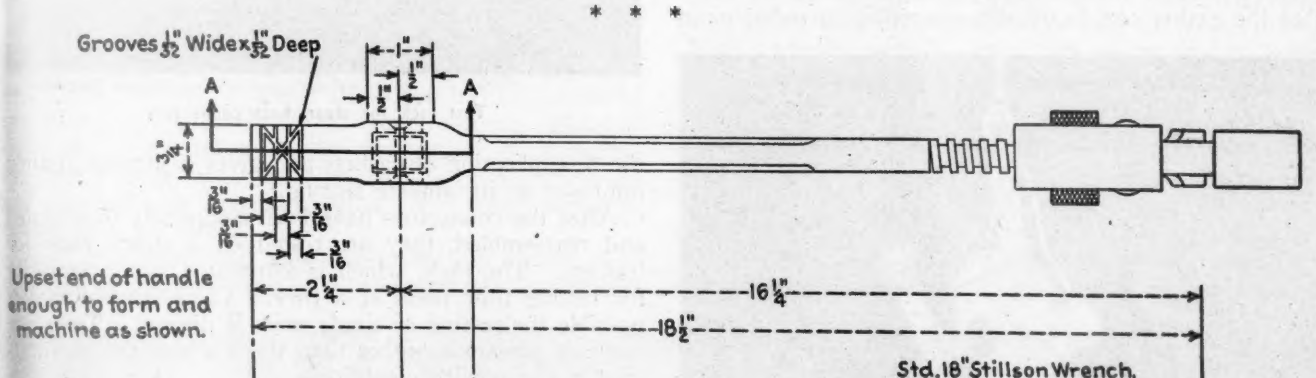
242—*Q.—Explain how to change position.* A.—Put the brake valve handle in full release position, pull out the shifter latch, swing the shifter lever 180 deg. and release the stop pin into the hole in the brake valve body casting.

243—*Q.—What does the brake valve handle control when the shifter lever is in its forward S. A. position?* A.—The self-lapping portion which automatically laps off the flow of air when the applied pressure builds to a value corresponding to a definite position of the brake valve handle.

244—*Q.—How many positions has this brake valve handle?* A.—Three. (1) release and running position at the extreme left; (2) application position which extends through the arc up to the quadrant notch, the latter being full self-lapping position and (3) emergency position, at the extreme right.

245—*Q.—How is the application pressure increased or decreased?* A.—The zone between release and quadrant notch is the application zone for service applications of the HSC electro-pneumatic brake system. The amount of application depends on the handle position in the arc, starting with O in release and increasing to 75 lb. maxi-

* * *



Balky and stuck doors on box cars on the New Haven yield readily when worked on with this roller device built into the end of a Stillson wrench usually carried by car inspectors—Excessive straining by workmen with the danger of resultant injury is done away with—P. J. Hogan, supervisor of car inspection and maintenance, is responsible for the development

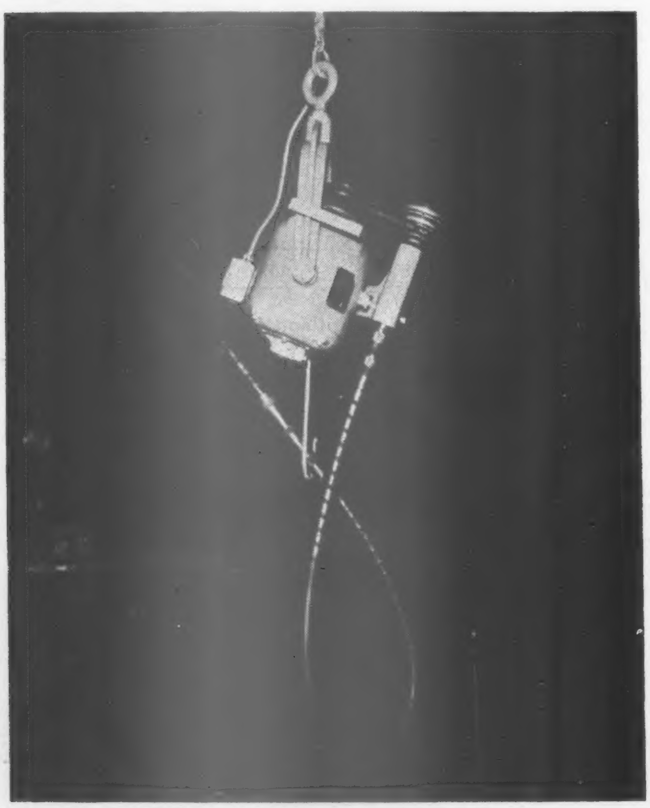
mum with the handle in the full application notch. No fanning of the handle is necessary as the brake valve itself automatically builds up the application pressure to the amount corresponding to handle position and then automatically laps off.

246—Q.—*What operates to vent control pipe pressure to the exhaust?* A.—A cam on the brake valve shaft engages a cam dog which in turn engages a pusher, attached to the pusher are two levers which form a balance lever. In the release position of the brake valve handle the cam is in its lowest position so that the balance lever floats freely and the inlet valve spring holds the inlet valve seated, and a spring unseats the exhaust valve, opening the brake valve cavity *B* and, therefore, control pipe to the brake valve exhaust.

Two Reading Car Shop Devices

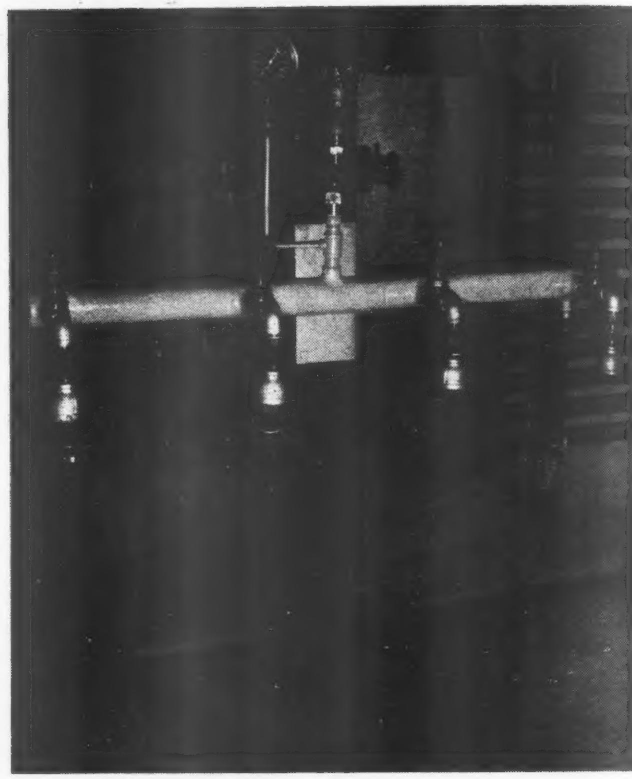
Repairs to Steam-Heat Connectors

When gaskets are removed from metallic steam-heat connectors used in tenders and passenger cars it is found that the gasket seat is usually somewhat corroded or at least that there is a surface film of oxidation which might later lead to a fully corroded condition. The Reading makes a practice of polishing the gasket seats by the use of a carborundum cloth polisher which is mounted on a spindle.



The polisher for cleaning gasket seats is driven by a flexible shaft from a motor suspended over the work bench

The spindle is driven by a flexible shaft from a motor suspended over the stripping and reassembly bench in the repair shop. The method has been found to be effective in providing a clean, polished seating surface for the re-application of gaskets and gives assurance against improper or incomplete seating.



Test rack for steam-heat connectors

After the connectors have been completely overhauled and reassembled, they are tested on a steam rack for leakage. The rack, which is illustrated, has a capacity for testing four units at a time. Valve control makes possible the testing of single units if desired. Tests are made at pressures higher than those which are encountered under service conditions.

Pipe Reamer

Removing burrs from the inside of cut lengths of pipe is a problem in any shop where a considerable amount

Pipe reaming machine operated by compressed air

of pipe work is being done. At the Reading car shop in Reading, Pa., the air-brake foreman has designed and built a machine which gives excellent results. An air motor is mounted rigidly on one end of a work bench to hold the reamer and a clamping device on a movable carriage is set in the bench adjacent to the reamer. The clamp opening has been made large enough to accommodate the largest pipe which is employed in car construction or repairs.

The operator places the pipe to be reamed inside the clamp which is operated by compressed air controlled by a foot pedal. The same pedal when depressed to lock the clamp also sets the reaming motor in operation. The movable carriage on which the clamp is mounted is also air operated and is advanced and withdrawn by means of a hand-operated control. An operator and helper at this machine produce more and better work than was formerly obtained when pipe cut to length was clamped in bundles and the ends reamed with a hand-held motor.

Wheel Lifting Jack

At the Denver & Rio Grande Western car shops, Denver, Colo., the use of wheel sticks for turning mounted car wheels, when being moved from receiving tracks at right angles to storage tracks or various machines in the wheel shop, has been eliminated in order to avoid any possibility of marring journals and contributing to subsequent hot boxes.

Both a portable and a semi-permanently located, air-operated lifting jack, used for turning mounted car wheels at the D. & R. G. W. car shop, are shown (left to right) in the illustration. Each jack consists of an air-cylinder with 8-in. inside diameter and 4½-in. stroke, mounted on a steel base plate which, in one instance, is lightly bracketed to the floor in some desired semi-permanent location and, in the other case, is equipped with wheels for easy portability about the wheel shop or yard. The supporting base for the portable jack, made of ⅜-in. boiler steel, is given a 6½-in. offset by means of two right angle bends and the upper shelf bolted to a solid axle provided with two 10-in. rubber-tire wheels. A steel socket welded to the outer end of the plate affords convenient means for inserting a wood handle which can be easily removed when not needed.

Referring to the illustration, it will be noted that the truck axle is supported just high enough so that the wheels clear the floor and thus do not carry any of the weight when the air jack is in use. When the weight is removed and it is desired to move the jack to another location, the handle is inserted and a relatively light pressure on it will tip the base plate enough to bring the weight of the jack on the 10-in. wheels and the jack can then be readily moved to any part of the wheel shop or wheel storage tracks desired.

The upper end of the air-cylinder piston rod is equipped with a 5-in. by 12-in. steel plate which has two ¾-in. angles welded at the outer edges, thus serving to hold the car axle against rolling off the jack. The axle-supporting plate pivots on the end of the piston rod so the car axle and mounted wheels may be easily turned in a horizontal plane as soon as air pressure in the cylinder raises the wheels off the track or floor. Since the lift of this jack is limited, one or more false axle-supporting plates is applied over the main plate as required to bring the bearing surface nearly up to the level of the axle of larger wheels. The additional supporting plates have angles welded to the bottoms. These angles are spaced so that all of the plates rest closely together and are held against slipping.

Air supply to the semi-permanent jack is provided through a pipe in the floor. In the case of the portable jack, a 20-ft. section of hose permits the jack to be operated 20 ft. on either side of a number of air outlets spaced as required along the wheel supply track and located of course on or near the track centerline.

Two types of wheel-lifting jacks used at the D. & R. G. W. car shops, Denver, Colo.

These two types of wheel-lifting jacks have demonstrated their value at the D. & R. G. W. car shops and have the additional advantages not only of avoiding journal damage but saving manual labor and contributing to safety.

IN THE BACK SHOP AND ENGINEHOUSE

Boiler Makers Interested in

Welding and Allied Processes*

Parts fabrication speeded by means of automatic cutting and welding equipment—Flame priming before painting helpful—Flame hardening increases wear resistance

Much must be left to the knowledge, experience and ingenuity of the operator, the welding foreman and other supervision in the repair and reclamation of locomotive and car parts by autogenous welding methods and in the use of oxyacetylene equipment for automatic and manual cutting. Resourcefulness of operators and foremen in adapting existing facilities to increase capacity has become a vital contribution to the war effort. Conservation, not only of specified critical materials but of all types of useful products, involves the manufacture, use and operation of all types of equipment, such as generator sets, cables, electrode holders, oxyacetylene cutting and welding blowpipes, regulators, and, particularly, tips, nozzles, hose, attachment accessories, and welding rods and electrodes.

Autogenous Welding

Much has been said heretofore concerning this subject and many committee reports have been prepared from time to time illustrating various designs for application to locomotive fireboxes, tenders, and other parts passing through the boiler shop. Extension of the uses of the welding processes in wartime, however, deserves some mention here.

In the early days of fusion welding the material used as welding rod was identical with that to be joined. It was not long, however, before it was realized that this type of welding rod did not suffice; that certain phenomena took place in the welding operation and that these phenomena could be directly influenced by the presence or lack of relatively small amounts of impurities or of alloying elements in the rod. Better understanding of high-temperature metallurgy has resulted in an extensive use of the various alloys to improve the quality of welding-rod deposits.

The use of welding in the fabrication and repair of the many parts that are the responsibility of the boiler department may be listed, in part, under the heading of autogenous welding (electric and oxyactylene) as: preparation and assembly of new fireboxes; patches; combustion chambers; smokeboxes; boiler-shell sheets; front flue sheets; wrapper sheets; syphons or circulators; mud rings; waist sheets, etc.; restoring staybolts and wash-out holes; ashpans; grate bars; grate-bar side frames; front-end exhaust and draft appliances; new work and repairing of tank wells, tender frames, aprons and miscellaneous plate work; safe ending of flues.

Automatic Welding

The Welding Handbook of the American Welding Society, 1942 edition, describes the most recent innovation in the automatic welding field as "submerged melt-welding", a process generally known as the Unionmelt welding process. This process is an electric welding method which provides an automatic means for making butt welds, fillet welds and plug welds of exceptional quality and high strength in any commercially used thickness of low carbon and medium carbon steels, stainless, and many other alloy steels.

The process uses either alternating or direct current. Currents are from 25 to 50 volts across the welding zone and the welding amperages are much higher than those used with metallic arc welding processes. By using various combinations of amperage, voltage and welding speed the shape and reinforcement of the weld can be varied and the depth of the weld penetration can be regulated as desired.

Speeds can be obtained as much as twenty times faster with this process than with other methods. For example, high-quality butt welds with 100 per cent penetration can be completed in one pass at the rate of 48 in. per min. on Z-bars for coach and car center sills and at the rate of 5½ to 6 in. per min. in 2¼-in. steel plate for Diesel switcher bed plates.

Welds can also be rapidly made in very thin materials. In the welding of 18-gauge stainless steel for car sides speeds of up to 60 in. per min. have been obtained. Welds made with this process have unusual strength, ductility, shock resistance, uniformity, density, and corrosion resistance with physical properties often better than those of the base metal.

The process has been approved and accepted by many of the regulatory bodies governing the construction of ships and pressure vessels. Many thousands of feet of such welding have been done on railroad equipment built under A. A. R. and I. C. C. regulations. As a result of the flexibility and quality of the process, it has been possible for railroad equipment manufacturers to utilize this method for car and locomotive construction without basically changing the designs approved by railroads and railroad associations. It has been adopted as standard in the construction of parts for streamline Diesel locomotives, such as crank cases, generator frames, engine beds, and rails. It has also been used ex-

* From a report on Topic No. 2 prepared for the 1943 year book of the Master Boiler Makers' Association.

tensively in the construction of a number of different types of railroad freight cars, including box cars, tank cars, hopper cars, refrigerator cars, and gondolas, and also in the construction of tank-car underframes and tanks for these cars. It is now being considered by several of the major railroads for use in repair shops and for the construction of parts of equipment such as bolsters, passenger-car truck frames, water tenders, and for the restoration of locomotive driving-wheel centers and other parts.

It will effect many economies in the fabrication of special shapes so frequently used in the construction and maintenance of railroad equipment, such as on unequal-section T-irons, channels, angles, and many other parts where ordinary butt or fillet welds will serve to join standard shapes to make the specials.

Oxyacetylene Cutting—Automatic and Manual

Although production operations and repair operations are widely divergent in nature, the use of automatic shape-cutting machines has proved to be economical and adaptable in both fields. For example, in the car department when hopper cars are undergoing repairs, hopper sheets, slope sheets, ridge sheets, side stakes and hopper doors make up a large volume of the new parts required. A considerable saving in time is made when a number of plates are clamped tightly together and cut at one time. For this operation, plates of ¼ in. thickness are piled approximately 12 high and other thicknesses of plate to an equivalent height. More satisfactory pressings are obtained when plates are cut with the oxyacetylene flame than is possible where plates are fabricated by coping and shearing. The piled-plate cutting procedure is frequently of advantage in the boiler shop when duplication of plates is desired.

In oxyacetylene flame cutting most work is on standard parts. The machines automatically follow a template made up to produce the desired contour. Special shapes can readily be cut with a hand tracing unit which is regular equipment on most automatic cutting machines.

Many economies can be effected in preparing plates or fabricated parts for new fireboxes, patches, combustion chambers, smokeboxes, course sheets, front flue sheets, wrapper sheets, waist sheets, aprons, mud rings, ash pans, front and exhaust and draft appliances, new work and repairing of tank wells or sections, bracing, splash plates, tender frames, aprons and miscellaneous plate work.

Flame Priming

Prolonged life for any part of railroad equipment is at all times uppermost in the mind of every supervisor. Oxyacetylene flame cleaning of plate surfaces prior to the application of preservative coatings helps in this.

Research into the protection afforded steel surfaces by painting indicates that the preparation of the surface is equally as important as the paint itself. The surface, in addition to being cleaned of loose scale, rust, and contaminants, should also be dry and warm, because it has been shown that as little as a single molecular layer of moisture or some other incompatible material on the surface will not only prevent satisfactory bonding of the base coat but will also permit corrosion to continue after the coat has been applied. On a warm, dry surface, the paint will flow readily, continuously wetting the entire surface and carrying the inhibitors into intimate contact with the surface where they are needed for effectiveness.

While the beneficial effects of painting on clean, warm and dry surface have long been realized, it was not until the oxyacetylene flame-priming process was introduced several years ago that all three of these desired conditions could be achieved. Since its introduction, flame-priming has proved its efficiency, speed, and economy in theory and practice, as evidenced by the fact that well over 20,000,000 sq. ft. of steel surfaces are now being treated by this process each month.

The flame-priming process consists of passing over steel surfaces a series of closely spaced oxyacetylene flames that have an extremely high temperature and velocity. As a result, all mill scale that is not tightly bonded is popped loose by sudden thermal expansion. At the same time, physically absorbed and chemically combined water is driven off from any rust that is present, leaving stable oxides in its place. Other contaminants present, such as oil and acid salts, are also consumed or disintegrated by the flames. The surface is then swept or wiped free of loosened foreign material and painted while still warm.

This procedure not only brings about improved corrosion resistance by the paint coating but also increases cleaning and painting rates and reduces setting time for the paint. As a further advantage, painting can be carried out under conditions of low prevailing temperature or dampness which would otherwise cause major delays. The time saved with the process is of particular importance at present when continuous production without delays in the fabrication and painting of steel is required. The process also finds increasing application in the reconditioning of previously painted surfaces that have become badly corroded and pitted, particularly industrial structures subjected to highly corrosive conditions. The action of the flames pops the heavy rust loose even in deep pits and drives off any chemical salts, acids, or gases that may be clinging to the surface. Materials, such as pipe that has been underground, are freed of mud and moisture simultaneously.

Flame Hardening

During the past decade, flame-hardening of gear teeth of all types has gradually become a standard operation and there has been an active development of the process to include the hardening of common wearing surfaces such as cams, guides, coupling boxes, pulley sheaves, roll wobblers, ball and roller races, crankshaft journals and cylinder liners. In the railroad field active development has been going on since 1939. Work was started in this field only after it was determined that apparatus and technique had been developed to a point of satisfactory flexibility and standardization.

Flame hardening by the oxyacetylene process must be differentiated from casehardening, carburizing, nitriding, or any other practice that involves a chemical change in the surface of the material. The flame-hardening process does not alter the chemical composition. When the process was first introduced the impression arose that the excess acetylene flame added carbon to the steel but this is not always true. A strictly neutral oxyacetylene flame is used as a heating medium and the hardness is produced by quenching while the surface of the steel is still above the critical temperature.

The intensity of the oxyacetylene flame induces heat so rapidly that it penetrates the material only a fraction of an inch. This imparts to the surface of the metal a hardened case which may vary in depth from a mere skin to ¼ in., depending upon the composition of the base metal, the operating methods used, the length of heating time, the quenching media and similar factors.

When steel is heated to above its upper critical point carbon is brought into a state of solid solution with the iron; or, in other words, carbon is diffused uniformly

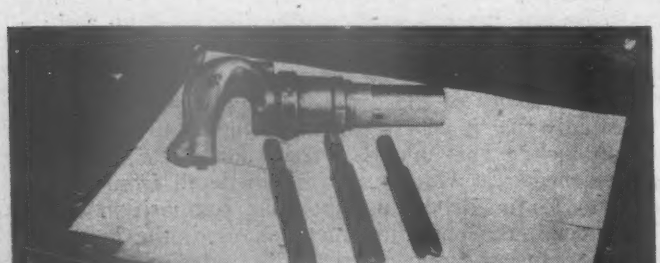
throughout the mass. If the heated mass is then allowed to cool gradually to room temperature, the carbon is precipitated to the grain boundaries, producing a coarsely grained structure which is relatively soft. When cooling is rapid or sudden, as in the flame-hardening process. the constituents do not have time to come out of solution and the structure that results from the heating is stabilized and arrested. Thus, a hard or martensitic structure is formed at the surface. There is no sudden change in chemical analysis and also no sharp line of demarcation between the hardened zone and the softer core such as is found in casehardened work. This fact is due to the balancing or tempering action of the metal beneath the hardened surface which produces a gradual transition from the hard martensitic structure at the surface to troostite, then sorbite, and finally to the original unaffected structure of the core. The increased toughness resulting from this physical condition, combined with the higher Brinell hardness, accounts for the successful wear resistance of parts that have been given this treatment. The hardness zone produced is, at least, two or three times the depth of that obtained by carburizing and will not spall, check or crack with impact, vibration, or deformation. In the railroad field, flame-hardening has been used with success on such parts as chafing castings, guides, valve crossheads. links, driving-box shoes and wedges, equalizers, furnace bearer shoes, shear blades and forming and pressing dies.

These newer procedures and many similar long-established applications of welding and cutting are thus contributing toward helping the railroad boiler shops and other departments make the most of available facilities for keeping equipment in the best running condition through these war years.

The report was signed by F. C. Hasse (chairman), general manager, Oxweld Railroad Service Company; J. M. Stoner (vice-chairman), supervisor of boilers, New York Central; J. W. Kenefic, superintendent railroad service, Air Reduction Sales Company; J. H. Lewis, assistant general boiler inspector, Atchison, Topeka & Santa Fe; S. G. Longo, assistant general boiler foreman, Southern Pacific; L. J. Murray, general boiler foreman, Western Maryland, and Thomas Taylor, foreman boiler and welding department, Steel Company of Canada.

Radius On Main and Side Rods

A pneumatic scaling hammer having a $1\frac{5}{16}$-in. bore and a $1\frac{1}{4}$-in. stroke is used with specially ground tools for finishing main and side rods with a $\frac{1}{8}$-in. radius at the West Albany locomotive shop of the New York Central. When used by a skilled operator this method produces



A chipping hammer with specially-ground chisels is used to obtain a $\frac{1}{8}$-in. radius on rods

A smooth finish is obtained by operators skilled in the method

work of such smoothness that no grinding is required. A light finishing rub by hand with an emery or carborundum cloth is sufficient to remove the minute irregularities in finish which are occasionally encountered.

Stripping Air Pumps

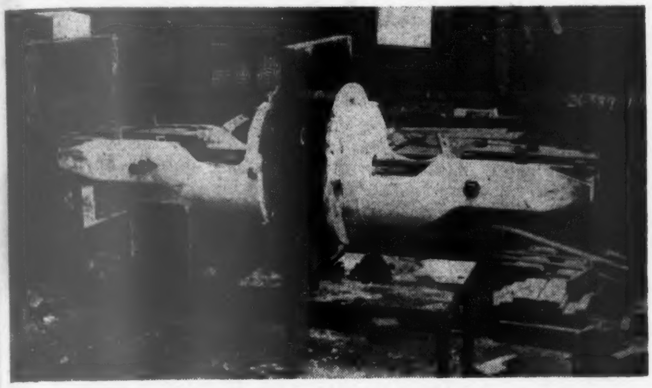
When locomotive air pumps are being overhauled the floor at the working location is not a clean spot to be around when the stripping operation begins. But the

Rack for stripping air pumps with sludge cart in position

accumulation of sludge found in them is no longer a problem in the machine shop on the Reading. Pumps are stripped on a rack under which an open-top cart is run into which the sludge drains as the heads are removed. The cart has a coupling connection for attachment to the regular shop tractors and it is pulled to a disposal point and emptied as needed.

Lining Up Valve-Stem Crossheads

The Erie at its Hornell locomotive shop is using a jig for lining up valve-stem crosshead guides which produces uniform settings and eliminates the necessity for working in the usually congested and inconvenient area around



Backing plate which insures accurate alignment of guides for fitting of crossheads

a locomotive on the erecting floor. The guides are mounted on a backing plate in pairs and necessary adjustments for the fitting of the crossheads are made while the guides are so mounted. When the work is completed they are ready for application to the locomotive without any necessity for further adjustment after they are applied.

The backing plate is drilled to accommodate any of the guides in use on Erie power.

Grinding Welds on Firebar Grate Fingers

Firebar grate fingers which have been worn below required dimensions are reclaimed on the New York Central by the oxyacetylene welding process using a cast-iron filler rod. The weld deposits on the lugs of these parts cannot be controlled closely enough so that grinding is not required and it was formerly the practice to grind the weld on the lugs to required dimensions on the periphery of a large wheel. Operations have now been speeded and uniform results assured by a new device.

Firebar grate fingers are rebuilt by welding and finish ground to size with this device

Two motor-driven grinding wheels have been mounted in a rigid frame on sliding ways which permit their adjustment for maintaining correct spacing between wheel faces as wear occurs. The grate fingers are placed in a holding slot on a carrier which is advanced into the space between the wheels by means of an extension arm. No clamping of the fingers in the carrier is required because the wheels are adjusted to rotate toward the work holder and exert a downward pressure on the grate finger as the holder enters the space between the wheels. Excess weld metal on the four lugs of the grate fingers is quickly and evenly removed by the action of the wheels and the reclaimed parts are returned to service with the original dimensions restored.

Material Storage Racks

One of the best methods of keeping locomotive shops orderly in appearance and, at the same time, conserving floor space is to provide suitable racks of one kind or another for holding various locomotive parts while in the shop awaiting or undergoing repairs.

At the Sacramento, Calif., general shops of the Southern Pacific, for example, power reverse gears are

Power reverse gears are supported on a four-position revolving rack

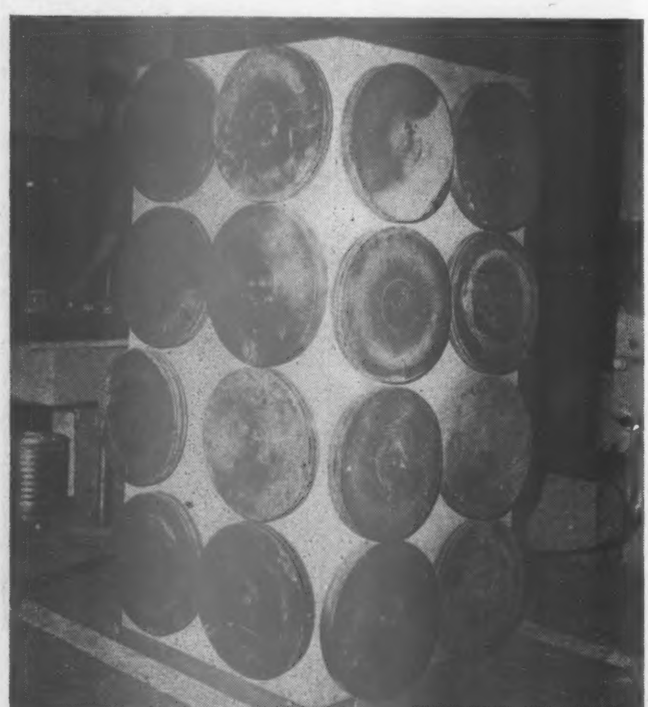
kept, while in the shop, bolted in a vertical position on a special rack, shown in one of the illustrations. This rack consists of an angle-iron frame mounted on a 4-in. pipe shaft, set vertically in the shop floor. The frame revolves on the central shaft by means of a thrust bearing at the bottom and a ball bearing at the top. It has four sides and is designed to support four power reverse gears at one time. A jib crane overhead facilitates both the application and removal of the power reverse gears.

Another illustration shows a storage rack for air-

Orderly air compressor steam and air cylinder-head storage

compressor steam and air heads. This rack consists of a series of steel plates securely anchored to the shop floor and provided with pins near the top on which the air-compressor heads are hung with faces towards the plates so that they are protected from damage. The rack is located adjacent to the work bench where these heads are repaired, thus making them easily accessible and saving floor space. It will be noted that each plate accommodates two heads, the steam head on one side and the air head on the other.

The third view illustrates an unusually convenient



Wood box-type storage rack with a capacity for 32 air compressor piston-rod assemblies

storage rack for air-compressor pistons and rods. This rack is made of wood (box-type construction) 30 in. square by 52 in. high. Holes are bored through the sides in various positions so that eight large pistons and rods or twelve smaller high-pressure assemblies are accommodated per side. The rack will, therefore, hold 40 piston and rod assemblies which would take up a lot of space by almost any other method of storage. Besides saving space this rack makes all individual pistons and rods easily accessible and prevents possible damage to the rods.

Locomotive Boiler Questions and Answers

By George M. Davies

(This department is for the help of those who desire assistance on locomotive boiler problems. Inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless special permission is given to do so. Our readers in the boiler shop are invited to submit their problems for solution.)

Flange Lap on Tapered Courses

Q.—Will you please explain the proper method of allowing flange lap on the tapered course of a locomotive boiler having a double-riveted circumferential seam. Are the holes put in before or after bending? How is the flange or kink usually put in?—M. F. K.

A.—There is no rule covering the allowance that should be made on the length of the plate at the lap of

Where taper is not too pronounced as in the sketch on the left, the flange lap allowance shown on the right will prove satisfactory

a tapered course. Some boilermakers make an allowance while others do not. The amount of the allowance is largely a matter of opinion based on the experience of the boilermaker. For a tapered course where the taper is not too pronounced, the allowance as shown, has been found satisfactory. The holes for the circumferential seams as well as all other holes are punched or drilled in the sheet before rolling. The holes are necessarily made small to permit alining the holes properly after assembly by reaming the holes to the proper size. The kink or flange is either made by sledging after the sheet is rolled into the conical shape, or, in cases where the taper is not excessive, the kink or flange is made in the rolls by inserting a filler piece the width of the circumferential seam whose thickness is equal to the taper of the sheet. The sheet and filler piece are then passed through the rolls together, in this way more uniform and accurate cylindrical ends can be obtained.

Patch Considered As Longitudinal Seam

Q.—In designing boiler patches, why is the efficiency of the patch made at least equivalent to that of the longitudinal seam?—F. E. R.

A.—In the formula for calculating the safe working pressure of a boiler:

$$WP = \frac{T \times t \times E}{R \times F}$$

Where

WP = working pressure
T = tensile strength of the boilerplate
t = thickness of sheet
E = efficiency of longitudinal seam
R = radius of boiler (inside)
F = factor of safety

the patch would be considered as a longitudinal seam and, therefore, the efficiency of the longitudinal seam as submitted in the formula would be the efficiency of the longitudinal seam or the efficiency of the patch, which ever is the least. By making the efficiency of the patch at least equivalent to, although preferably greater than, that of the longitudinal seam, there is no possibility of reducing the safe working pressure when applying a patch.

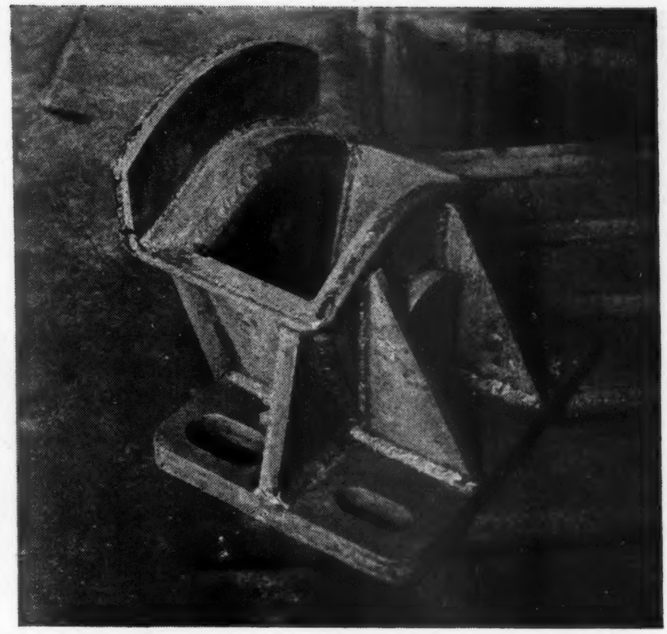
Steel Electrodes For Welding Locomotive Parts*

By J. W. Kenefic†

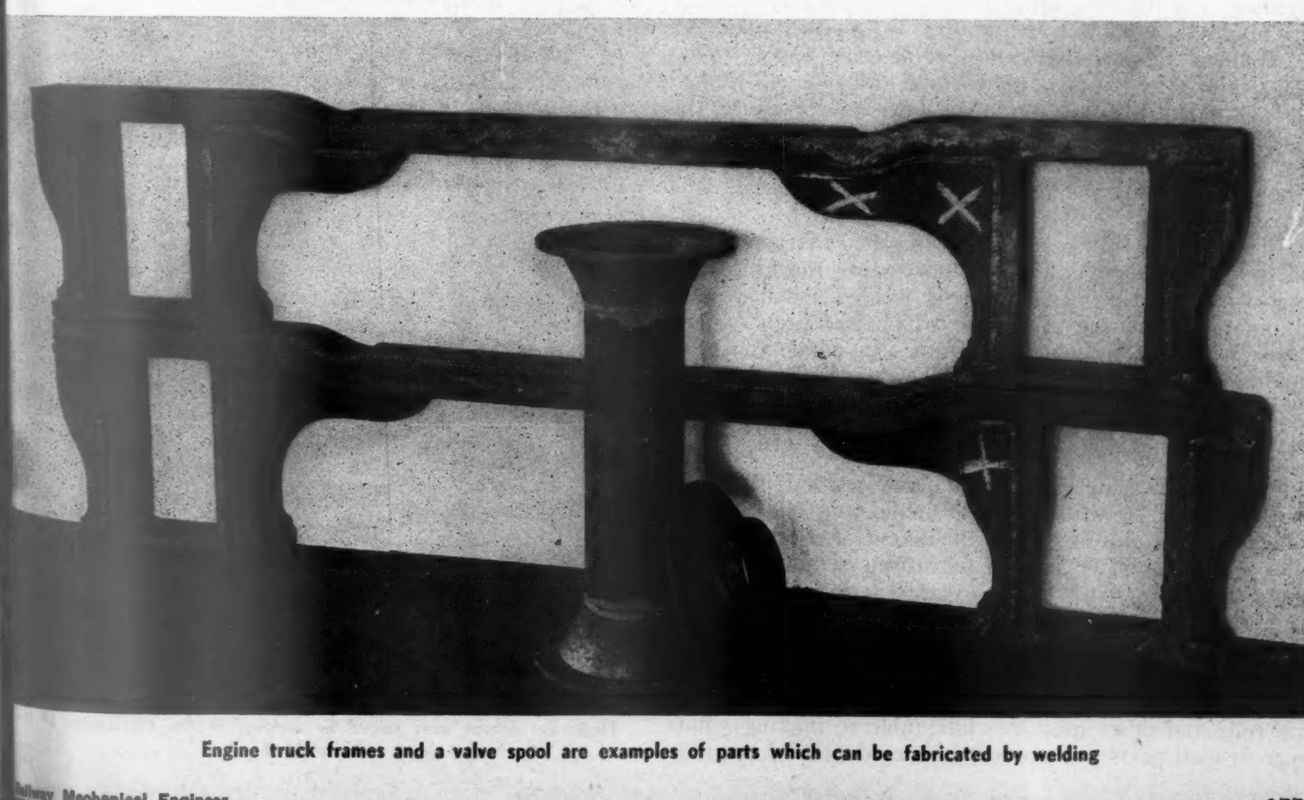
Quite a number of worn locomotive parts are restored to original size with steel weld metal. Stoker screws are among the parts which are rebuilt at each shopping of the locomotive. Arc welding is employed, using an electrode which assures good control of the molten metal in bridging gaps. The screw can be mounted horizontally unless it shows a tendency to warp in this position in which case it should be supported vertically.

Brake heads are customarily built up by arc welding with steel electrodes, this being another operation which can be done repeatedly. For speed and convenience the brake head may be mounted on a simple welding positioner, making the deposits on the pads which bear against the brake shoe.

Some shops still employ manganese bronze weld metal of roughly 60 per cent copper and 40 per cent zinc analysis as a bearing metal in building up worn parts. This practice is a carryover from the time when no specific bearing metal rod was available and its con-



Flame cutting and welding made possible the assembly of this coupler housing



Engine truck frames and a valve spool are examples of parts which can be fabricated by welding

* Abstracted from a part of a paper delivered before the railroad welding session of the American Welding Society at Chicago, October 18, 1943. Another article deals with the portion of the paper on the use of bronze electrodes.

† Superintendent railroad service, Western division, Air Reduction Sales Co., Chicago.

Flame gouging is used to prepare cracked couplers for welding—Repair welding is usually done by the electric arc method but the oxyacetylene process can also be used

tinuation is not to be recommended. The manganese bronze produces a hard surface, sometimes even harder than the ferrous metal surface it bears upon, so that it does not perform the function expected of a bearing metal.

The number and variety of parts which can be and have been fabricated by welding is large. Almost invariably the part is fabricated at a cost lower than the outside purchase price though usually availability is today a more pressing factor than cost.

An outstanding example of fabrication is the driving box. Three flame-cut parts are welded together, stress relieved, and machined on crown and lateral faces. The crown brass is entirely weld-deposited, using spreaders at the cellar fit to prevent its drawing together during welding, and building up to allow a depth of ¾ in. after machining.

A much simpler fabrication is a valve spool. This consists of a length of seamless tube and two bell-shaped ends, welded together on a jig-positioner. Since the spool is constantly in reciprocating motion while in service, any reduction in weight is useful in reducing wear. The fabricated spool is appreciably lighter than the standard part.

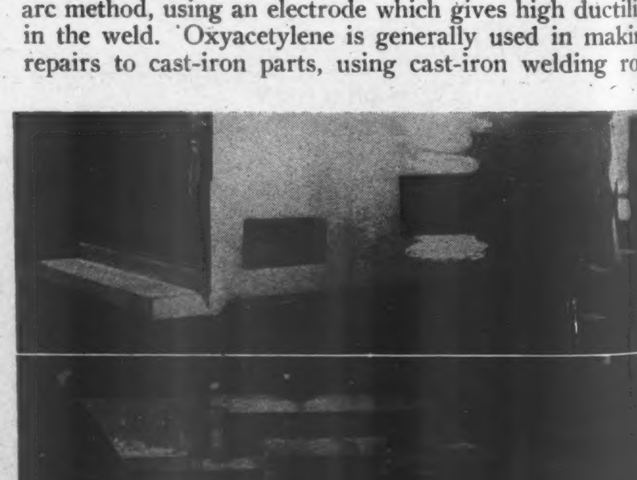
Engine-truck frames are quite simple to fabricate. The parts are flame cut with a shape cutting machine with surprisingly little waste. These welded truck frames eliminate one source of trouble which had been experienced with conventional type frames in which the bolts holding the pedestals frequently become loose.

A drawhead exemplifies the heavier fabrications made in some shops. To carry the heavy load which this assembly must sustain in service, it is made up of heavy thicknesses of plate cut, beveled and welded in a rectangular box structure. Well made coupler housings can be made up of simple flame-cut sections welded into the assembly. Such a fabricated structure shows good adaptation of design features to the welding operation.

An example of fabricated locomotive parts in which formed sections are used are cylinder heads. Since most railroad shops are equipped with power presses, bending rolls and other machines adaptable to making whatever formed parts are needed, it is evident that requirements for shaped sections in a weldment need be no deterrent in fabricating any replacement part.

Regardless of the availability of new cast parts, it is always good economy to make repairs to cracked or broken castings which can be reclaimed. The operation of gouging out cracks and filling with weld metal has become fairly widespread on such cast parts as couplers, car pedestals, and others which are subjected to severe pounding in service. Cracks in these parts are eliminated by using a hand gouging torch to burn away the metal surrounding the crack and then filling in the resulting cavity with weld metal. The operator can judge the proper depth of the gouge by the final disappearance of the dark red streak in the center of the burning reaction. Such a streak is caused by the presence of the crack. Parts are furnace annealed after the weld repairs are completed.

Welding on cast steel is done usually by the metallic arc method, using an electrode which gives high ductility in the weld. Oxyacetylene is generally used in making repairs to cast-iron parts, using cast-iron welding rod.



Flame-cut pieces were joined by welding in the fabrication of this drawhead

Motor Starter Maintenance

By L. A. Hester*
and
L. E. Markle†

Preventive measures which insure proper operation and long life can only be effective if the maintainer knows what a starter is supposed to do

WHEN the United States became involved in the war, the railroads were ready for the emergency. They have demonstrated their ability to transport the tremendous load of wartime freight and millions of troops, as well as the civilian traffic. The task is being accomplished daily with an efficiency that has won the acclaim of Government officials, the press and the public.

Naturally, this continuous severe duty on the equipment requires a well-organized maintenance program.

Contact pressures are very important and should be checked—Weak springs and overworn thin contacts will reduce contact pressures

Each item of electrical equipment is performing a definite service whereby a failure would undoubtedly result in delays. Maintenance should be planned on the basis of preventing failures since this not only saves time and results in less use of materials but is also most economical.

A simple motor starter is one small item of sufficient importance in the various railroad shops that it can be classed as an item to be discussed separately.

Satisfactory maintenance of electrical equipment requires competent men and a thorough and adequate plan of handling the inspection and repair work. Good inspection and prompt repairs will avoid high maintenance costs; complete replacements will often be avoided; lost time will be kept at a minimum.

Preventive maintenance begins with the proper selection of the motor starter. If it is not suitable for the installation, or if it has insufficient capacity, maintenance troubles are inevitable. The initial inspection of a new installation should be thorough and operation observed at load conditions before final acceptance is made. A time schedule for routine inspection should be established to meet the service requirements. As motors and their starters are always associated, a combined schedule can require inspection of both.

Do Not Lubricate Bearings

Oil and grease should never be applied to the bearings of a contactor or relay. Experience has indicated that oil or grease will cause dirt to accumulate and eventually result in a sticky, gummy accumulation that causes sluggish action. The bearings are designed with these requirements in mind and no lubrication is required on any part.

Bearing parts should permit contactors or relays to operate freely and without apparent friction. If parts are out of alignment and excessive friction does exist, it should be eliminated. Sluggish action will cause electrical troubles. Monthly inspections for severe service and semi-annual inspections for average service will do much to prevent bearing and friction troubles.

No bearings are required when the moving parts of a contactor or relay are relatively light and the magnetic forces can be made strong enough to lift the movable parts vertically to close the contacts. This is an ideal design as far as bearings are concerned. However, the moving parts must be guided within the solenoid and non-magnetic guides must be used to prevent magnetic sticking and sluggish action.

Replace Badly Pitted or Thin Contacts

Although contacts are generally thought to be subjected primarily to electrical duty, the mechanical duty is equally important. Endurance tests are made with no current through the contacts to observe how well they withstand the pounding, rolling and sliding or scrubbing action that occurs every time the contacts close. Contactor designs often provide a rolling action of the contacts so that the circuit is closed and opened on the contact tips instead of on the closed contact position.

When high currents that are difficult to interrupt are expected, powerful arc rupturing structures are supplied to force the arc off the contacts and quickly extinguish it. These arc-rupturing structures are called arc boxes or

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† Motor control engineer, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

blowout structures. When in operating position, they completely surround the contacts and must always be in correct position to rupture the arcs effectively. They are easily removed for inspection or replacement of contacts. They must be returned to proper position after inspection, so that the arc will be properly broken and the contacts will not be unnecessarily worn and burned.

Contacts should be renewed when badly burned or pitted and when worn thin. They should be clean but need not be smooth. In fact, a clean contact with a roughened surface comparable to coarse sandpaper is a very satisfactory condition and provides a contact surface as good as or better than a perfectly smooth surface. If a contact surface is pitted or burned and not worn thin, it can be cleaned and used again.

The method of cleaning is important. Coarse and crude filing wastes material and generally deforms the contact shape. The contact surfaces then have high spots and point contacts that are apt to overheat. Instead of filling, clean with sandpaper or by buffing wheel. A fine file is permissible if the contact shape is maintained. Emery paper should never be used as particles may adhere to the surface and cause unnecessary wear.

Silver contacts seldom require cleaning. They may look black and dirty because of the silver oxide, but, as the oxide is a conductor, cleaning is not often necessary.

The surface against which contacts are bolted is usually a current-carrying joint. A clean contact bolted to a dirty surface cannot give best results. Hence, when contacts are replaced, both surfaces should be thoroughly cleaned. Any traces of copper oxide should be removed.

The screws or bolts that hold contacts in place must be tight at all times. A loose contact surface offers high resistance and develops heat. This causes increased

The working parts of dashpots are machined to small clearances—They should be kept clean—Parts should move freely without friction—Correct liquid should be used and liquid level should be maintained

oxidation of the copper contacts. As copper oxide is not a good electrical conductor, this oxidation creates still more resistance and heat. This action is cumulative

Contacts worn through by long use or badly burned contacts must be renewed—Surfaces against which contacts are bolted should be cleaned—Clean copper contacts, though slightly roughened are entirely satisfactory—Silver contacts, though black in appearance, need not be cleaned—Be sure contacts are tight at all times

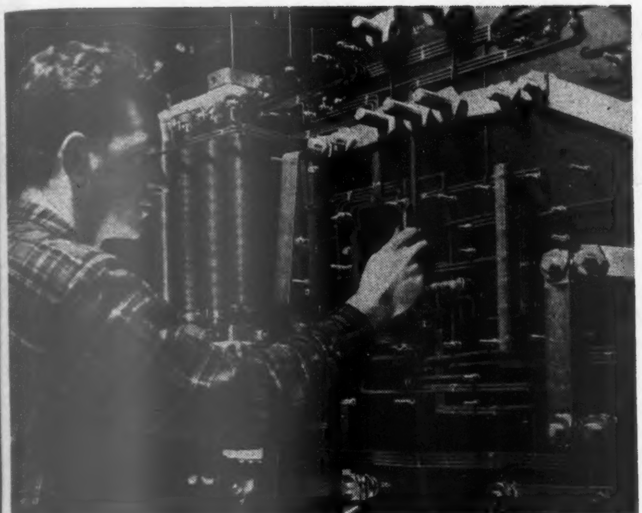
and eventually causes contacts to melt with resultant deterioration of the entire contact assembly.

When contacts open and close, the rolling and rubbing action combined with the slight burning of a normal arc combine to keep the contacts bright and clean. If the contacts operate very infrequently, the cleaning action does not occur, and a covering of copper oxide develops. The heating oxidation cycle may start and eventually overheating may develop even though the current or load is normal or less. For such conditions, silver contacts will probably give better service as silver oxide is a good conductor and heating does not develop. Silver contacts may also provide some relief in cases where a small overload condition is troublesome. They must, however, be used with some caution because they will not correct overheating caused by loose connections. As silver has a lower melting temperature than copper, silver contacts are more prone to become soft and "weld" or "freeze" together when subjected to high arcing temperatures.

Other special alloy materials are available that give reasonably good service under certain unusual or specific conditions. Contacts made of special materials should be used only on advice of the manufacturer of the device. Usually, they are rated at lower current-carrying capacities than similar contacts of copper or silver.

Contact Pressure Determines Current-Carrying Characteristics

The closed pressure of contacts is an important factor in their ability to carry current. A small contact with suitable contact pressure will carry more current than a larger one with little or no pressure. Renewal of thin contacts is required, as with wear they lose their contact pressure. It is important to keep the contact springs in good condition. Replace them if they have been damaged or have lost temper through exposure to high arcing temperatures.



All connections must be kept tight at all times. Loose connections are a frequent but very elusive cause of operating troubles

A monthly inspection of contacts for pressure, available life, surface condition, temperature, and tightness, should suffice for normal conditions. For severe operating conditions, a weekly inspection may be advisable.

Renew Frayed Shunts

Shunts are generally flexible bands of woven copper strands that carry current from the movable contacts to a stationary stud. If the shunt is unduly bent, its strands break and cause additional loading of the remaining strands.

Shunts with broken strands should be renewed to prevent overheating. The terminal connections of the shunt should be tight. Shunt ends are frequently silver plated or covered with special finishes to insure a clean contact surface of good current-carrying ability.

Coils Should Operate at Rated Voltage

After coils are wound they are treated with insulating varnish to improve their dielectric strength and make them a solid mass. This makes a coil less susceptible to mechanical injury, eliminates air pockets within the winding, and enables the coil to radiate heat more readily than an untreated coil.

A.c. coils are designed to withstand 10 per cent over-voltage and operate the devices at 85 per cent of normal voltage., D.c. coils will withstand 10 per cent over-voltage and operate devices at 80 per cent of normal voltage.

Over-voltage operates a contactor or relay with more mechanical force. This tends to shorten the mechanical life. Over-voltage also shortens the life of a coil because it operates at higher temperature. Low voltage will cause sluggish action. The contact tips may touch but may not be forced completely closed against the contact spring pressure. Under such conditions the contact tips will most certainly overheat and probably "weld" together. Voltage must be maintained within the specified range. Contacts must always seal closed.

On a.c. service, the coil current is much higher while the contactor is closing than after it is closed. A.c. coils are not designed to stand the open-gap or closing current continuously. If any mechanical interference prevents complete closure of the magnetic air-gap of an a.c. device, its coil will soon be overheated.

Open-circuited coils are easily detected because they cannot operate the device. A coil with some turns short-circuited might operate, but it would soon overheat and burn out. Most designs permit quick and simple replacement of a defective coil.

Dead-Center Opening Reduces Mechanical Vibrations

When a magnetic contactor opens, the movable part strikes the stationary stop rather forcibly. There is a "dead," or center of percussion point at which the effect of the blow is nullified. If the striking occurs at some other point, the device is subjected to mechanical vibrations and strains that reduce its mechanical life. This feature is vividly illustrated by the "sting" of a baseball bat if the ball strikes near the end.

Check Chart for Motor Starter Trouble

Cause	*What To Do*
CONTACTOR OR RELAY DOES NOT CLOSE	
No supply voltage.	Check fuses and disconnect switch.
Low voltage.	Check power supply. Wire size may be too small.
Open circuited coil.	Replace.
Push button contacts not making.	Clean and replace if badly worn.
Interlock or relay contact not making.	Adjust and replace if badly worn.
Loose connection or broken wire.	Check circuit with "flash light" (turn off power first).
Overload relay contact open.	Reset.
CONTACTOR OR RELAY DOES NOT OPEN	
Push button not connected correctly.	Check connections with wiring diagram.
Shim in magnetic circuit* worn, allowing residual magnetism to hold armature closed.	Replace.
Interlock or relay contact not opening circuit.	Adjust contact travel.
"Sneak" circuit.	Check control wiring for insulation failure.
Contacts weld shut.	See "Contacts Weld Shut."
CONTACTS WELD SHUT	
Insufficient contact spring pressure causing contacts to burn and draw arc on closing.	Adjust, increasing pressure. Replace if necessary.
Rough contact surface causing current to be carried by too small an area.	Smooth surface and replace if badly worn.
ARC LINGERS ACROSS CONTACTS	
If blowout is series, it may be shorted, If blowout is shunt, it may be open circuited.	Look at wiring diagram and see kind of blowout. Check to see if circuit through blowout is all right.
If used, arc box might be left off or not in correct place.	See that arc box is on contactor as it should be.
If no blowout used, note travel of contacts.	Increasing travel of contacts will increase rupturing capacity.
NOISY A.C. MAGNET	
Improper seating of the armature.	Adjust.
Broken shading coil.	Replace.
EXCESSIVE CORROSION OF CONTACTS	
Chattering of contacts as a result of vibrations outside of the control cabinet.	Check control pressure and replace spring if it does not give rated pressure. If this does not help, move control so that vibrations are decreased.
High contact resistance because of insufficient contact pressure.	Replace contact spring.
ABNORMALLY SHORT COIL LIFE	
High voltage.	Check supply voltage and rating of controller.
Gap in magnetic circuit.†	Check travel of armature. Adjust so that magnetic circuit is completed.
Too high on ambient temperature.	Check rating of contact. Get coil of higher ambient rating from manufacturer if necessary.
PANEL AND APPARATUS BURNED BY HEAT FROM STARTING RESISTOR	
Motor being started too frequently.	Use resistor of higher rating.

* D.c. only.
† A.c. only.

Dirt or Rust May Be Cause of Excessive Noise

D.c. contactors always operate quietly when closed. A.c. contacts may be noisy. The laminated magnetic structure, necessary on a.c. designs, must be held tightly together by screws, or rivets, or other means. Should the

laminations become loose, the assembly will be noisy.

Noise will also result if the movable and stationary pole pieces do not fit well together when the device is closed. Dirt or rust may prevent proper closure of these surfaces and cause objectionable noise. To prevent rust on these fitted surfaces during shipment, some grease is applied. The excess grease should be removed when placed in service to eliminate a "sticking" or sealing effect when the surfaces are first closed against each other.

The most important device in reducing noise of an a.c. device is the shading coil usually imbedded in a part of the laminated magnetic structure. This coil is often a single turn of wire or strap and if broken the noise will be most objectionable. If contactor is noisy, look first for a broken shading coil.

Oil-Immersed and Explosion-Tested Control

For high-voltage installations, in explosive atmospheres and areas of corrosive nature, such as acid fumes, the entire equipment is often completely immersed in oil. The oil should be maintained at proper level and should be kept clean, especially when used for insulating purposes. A monthly inspection of oil-immersed equipment is adequate unless service is so severe that the oil deteriorates rapidly.

"Explosion-tested" starters are intended for use in explosive atmospheres and do not require oil. These starters are built to specifications of the Underwriters' Laboratories. The enclosing cases are built to withstand high pressures that occur within the case if internal explosions should occur and to prevent flames escaping into the surrounding explosive atmosphere. If dismantled, the parts of an explosion-tested starter must be carefully assembled to be sure that all bolts, nuts and joints are tight. Operation in the explosive area, unless the starter is properly and completely assembled, is not permitted.

Relay Operation Dependent on Proper Liquid in Dashpot

When oil or any liquid is used in dashpots, regular inspections should be made to be sure that the dashpots are free of friction and the proper oil level is maintained. The liquids used in dashpots are tested for certain characteristics such as change in viscosity with temperature changes. A change in oil or liquid would therefore affect the operation of the relay. No substitution of oil or liquid used in dashpots should be made.

Thermal relays are subject to ambient temperatures and should be in a room temperature equivalent to that in which the motor is located. Otherwise the relays may not operate to the best advantage. For example, a thermal-overload relay should not be in a temperature much in excess of the motor room temperature unless proper allowance for the difference in temperature is made when the thermal heaters are selected.

Connections Must Be Tight and Clean

Loose connections are a frequent cause of trouble. They result in overheated parts that eventually must be replaced. Once tight does not mean they will remain tight. Periodic inspection is necessary. Changes in temperature, vibration and carelessness are all common causes of poor connections. They should always be tight and clean.

Resistors to dissipate heat may fail from excessive temperatures. If enclosed, the temperature may be reduced by ventilation. Overheating may be caused by insufficient ventilation, excessive current, or more continuous service than was anticipated in the design. Loose connections often cause local heating with eventual burned connectors. Grid or cast types sometimes break in handling or with frequent and sudden overheating and cooling.

Keep Starters Clean and Dry

Moisture, dirt and dust are constant sources of trouble as they reduce insulation values of insulated wires and cables. They constitute a leakage path across which breakdowns occur between points of different potentials that would never occur on clean and dry surfaces. Routine maintenance should remove dirt and dust by blowing with dry compressed air, wiping or washing with suitable cleansing fluid. Compressed air under too much pressure may drive metallic dust and dirt into insulation or lodge particles between stators and rotors of motors or in moving parts of contactors and relays.

Moisture may occur from condensation, humid atmospheres, spray or overhead dripping. Heaters are sometimes placed in enclosures to keep the interiors dry. They are generally arranged to be automatically effective when the equipment is idle because the normal heat of resistors and coils is sufficient while in operation. Drip-proof, water-tight and dust-tight enclosures may be provided.

Wiring

Moisture in conduits is a frequent source of grounds. Grounds cause false circuits that cause unexpected starts, prevent stopping by normal means, eliminate overload protection, and cause unsatisfactory operation. Any measures to prevent moisture in conduits are good insurance against trouble. When serious grounds develop, they are eliminated by cleaning the conduit and installing new wiring. Then insulation resistance should be checked regularly so that the presence of grounds can be detected and eliminated before trouble occurs.

All wiring should be kept in safe and good condition. Vibration will cause broken wires. Oil, moisture, dirt and grease cause insulation breakdowns. Chafing or rubbing against unprotected edges soon wears away all insulation at that point. Temporary wiring is hazardous. Nuts and lock nuts should be tight. Defective wiring is an outstanding cause of electrical trouble and fires. Regular inspection is necessary.

Temperature

High temperature is a sure sign of trouble. However, one must be sure that the temperature is excessive. To touch a cabinet or coil or motor and decide it is too hot is not a safe procedure because safe operating temperatures are often higher than one can comfortably feel with the hand. The best procedure is to know what temperature is considered safe and then actually measure it.

Here are the high-points that should be checked to keep motor starters in good operating condition: They must be free of oil, dirt and moisture. No oil should be used on contacts or bearings of contactors and relays. Connections should be tight and wiring should be safe. Movable parts of contactors and relays must move freely and without friction. Contacts should be clean and tight with correct pressure and not worn too thin. Arc-rupturing devices must be in operating position.

Motor Operates At 120,000 R.P.M.

An electric motor operating at the record-breaking speed of 120,000 r.p.m. has been built and tested by the General Electric Company, Schenectady, N. Y. The motor was developed for application to internal grinding machines used in finish grinding small holes, many less than ¼ in. in diameter. Although the motor will not be available for general use until after the war, another possibility for its use is in driving small drill chucks for drilling tiny holes in metals, using drills $\frac{1}{32}$ in. in diameter and less.

According to F. W. Baumann and D. H. Ware, G.E. motor engineers, the surface speed required to produce a high-grade finish economically by grinding should be about the same whether grinding a large or a small hole. A medium-size wheel rotating at a moderate speed gives the requisite surface speed but for small holes only a tiny grinding wheel can be used, hence the high rotating speed is essential.

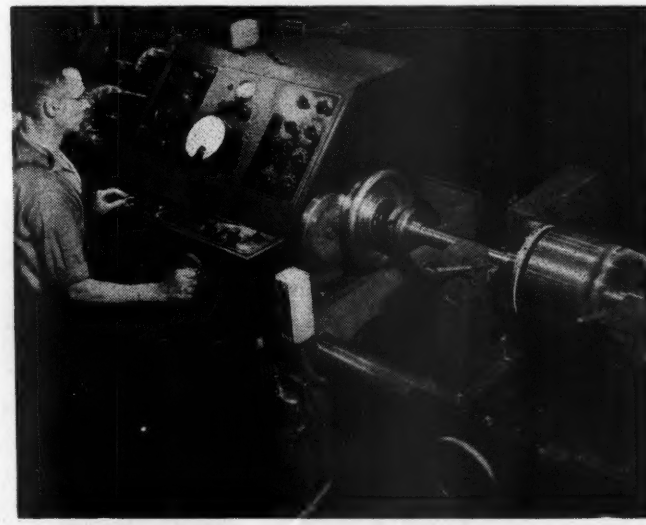
With normal voltage applied at 2,000 cycles, the new motor reaches full speed in less than a second. It is rated 3 hp. and weighs 7 lb., as contrasted with the standard 3-hp., 1,800 r.pm. motor which weighs 105 lb. A special oil-mist lubricated type of bearing is used. The amount of material used in the motor is so small, with a consequent reduction in radiating surface, that water cooling, requiring one-half a gallon a minute, is used.

Two three-hp. motors—The larger one operates at 1,800 r.p.m. and the smaller one at 120,000 r.p.m.

Precision Balancing

Unbalance of armatures can be located in ⅛ to $\frac{1}{10}$ the time required for mechanical balancing with a dynetric balancing unit used by Westinghouse Electric & Manufacturing Company at East Pittsburgh, Pa. It is possible to precision balance armatures for 50 to 200 hp. motors to $\frac{1}{10,000}$ of an inch of linear movement. The machine shown in the illustration has, during the past month, been used to balance about 1,000 armatures.

The procedure is as follows: The shaft of the armature is placed in floating bearings. The armature shaft is connected to that of a motor-driven, sine-wave generator. A known weight of molding clay is added to one end of the armature at the 0 reference point of the sine-wave generator index wheel. The armature is driven at 600 r.p.m. The sine-wave generator is adjusted until the rotor is in phase with the stator, at which point the armature is in balance with the machine. The weight of metal necessary to bring one end of the armature in balance is read on the scale of the large instrument in center of the panel. The horizontal movement of the armature, due to vibration, is transmitted by the floating bearings through a mechanical connection to an electrical coil whence it is electrically transmitted to electronic tubes which amplify the unbalance so it can be recorded by the instrument. The sine-wave stator index wheel indicates the place on armature with respect to the 0 reference point of the sine-wave generator index wheel where the weight that was read on the instrument must be added to bring that end of the armature in balance. The operator then repeats these steps for balancing the opposite end of the armature.



The balancer indicates both the amount and the location of the weight required to bring the armature into balance

* * *

Open pit copper mine showing benches—Electric locomotives are used to haul mine cars—Contact system is portable and is moved with the track across the benches as the inside bank is dug away

Painting Large Transformers*

By S. R. Negley†

Flow-coat method adopted by the Reading reduces time required, produces a fine finish, and does not waste paint

MAINTAINING the paint surface on large power transformers on which cooling tubes, fins or radiators are used, represents a difficult maintenance problem. As these equipments are usually constructed, the cooling surfaces as represented by these tubes of various shapes are so closely spaced that brush painting and cleaning of tubes by wire brushing, etc., is practically impossible. A large number of power companies, including ourselves, recognizing the impossibility of painting these surfaces by brush methods, have resorted to spray painting, and accordingly when our transformers were first painted under maintenance procedure a number of years ago, paint spray equipment was obtained for this purpose. Many of our transformers, however, are extremely difficult to paint even by the spray paint method, and extreme care on the part of the operator must be exercised if a satisfactory coating is to be obtained. The operation is tedious, requiring extremely careful application and inspection, and many of the surfaces cannot be hit directly with the paint spray.

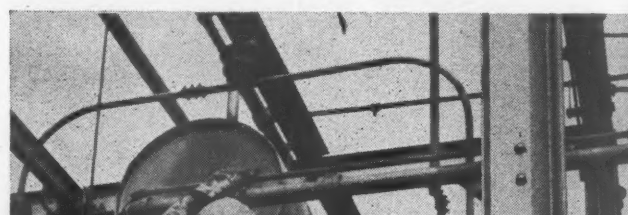
Pump equipment mounted on hand truck for flow coat painting—Small circulating pump driven by ¾ hp. motor—Flow of paint approximates five gallons per minute

In recent years there has been developed by the Sipes Paint Company, of Pittsburgh, co-operating with a number of power companies, a process of painting transformers called the "Flow-Coat" process. Using this method, the paint is virtually poured on the apparatus to be painted by means of a circulating pump and the paint is directed to the surfaces through a hose line, the nozzle of which consists of a flattened pipe. Using this process, the paint flows by gravity over all of the vertical surfaces and by which means the relatively inaccessible surfaces to brush and spray painting are easily covered.

The chief factors in the desirability of using this type of painting for large power transformers may be summarized as follows: assurance of complete coverage; economy of time; absence of paint mist as experienced with spray painting equipment, and simplicity of painting equipment.

When paint is flowed over the transformer surface, the coating is uniform at any level of the unit. It varies slightly between top and bottom, the bottom being heavier, but this is as it should be since corrosion first appears on the lower surfaces.

Although the superior covering obtained by the flow coat method would in itself justify the use of this type of painting, the more complicated the surface becomes the greater the labor saving which will result. While our experience during the past year has been limited to the painting of the transformers in only three of our substations, these being Wayne Junction, Chestnut Hill and Norristown, Pa., the labor saving resulting, particularly



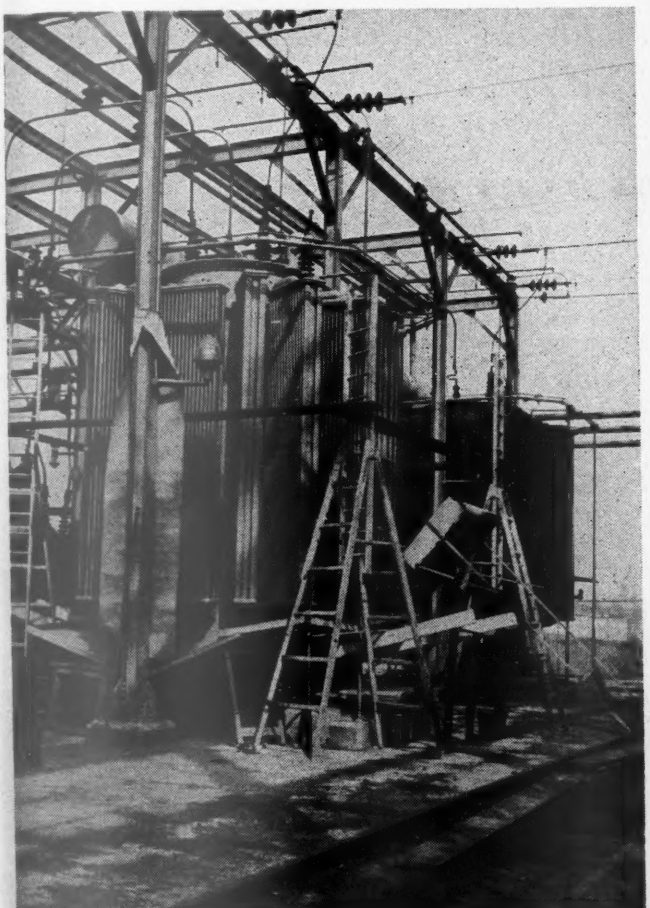
View showing use of pipe nozzle and flow of paint—In painting, flow is concentrated on top 18 in. of radiators and except for small voids, entire radiator is coated by flow from top section

* Courtesy Reading Railroad Magazine
† Electrical engineer, Reading Company

at the Wayne Junction substation, was very attractive.

At Wayne Junction we have three large 8,000 kva. capacity units, and in 1935, the last time these units were painted, a total of 82 man-days were expended in applying two coats by the spray paint method. This year, when using the flow coat process, two coats were applied for a total labor charge of 34 man-days.

The savings in the smaller transformers, such as we have at Chestnut Hill and Norristown, are not so great, since a considerable portion of the time is expended in setting up the necessary scaffolding, drip pans, etc. Even on these units, however, and with our inexperienced help, we expended slightly less man-days than by the spray



View of scaffolding, drip pans, deflectors, etc., in place prior to start of flow coating process

paint method, and during another painting season, as we become more proficient in the use of this equipment, additional savings will accrue.

As stated above, the setting up time represents a considerable portion of the total time consumed in the painting, as the actual time in completely coating all the radiator surfaces of one of our large transformers at Wayne Junction, where the equipment was properly set up, was only 45 minutes.

The use of this equipment avoids the necessity of workmen wearing respirators and the presence of wind does not result in coating on adjacent apparatus such as experienced with the spray paint method. On inaccessible surfaces the deposit of this mist frequently gives the appearance of a thorough paint job; whereas actually the protective film applied is very thin and paint failures will start at these points. The flow coat method, of course, eliminated any improperly coated surfaces of this type.

The equipment necessary for this method of painting

Paint flowing from radiators on to deflecting screens and into containers—This paint is poured into paint circulating system in continuous process

Covering small voids in bottom section of radiator—Note flow of paint along surface of tubes

consists of a motor, pump, strainer, pipe connections, and solvent hose. A bypass connection on the pump is used to regulate the flow of paint. The pans are made of sheet metal and are so arranged as to catch the drip from the bottom sides of the radiators and transformer surfaces. These pans are vented to each other and drip buckets placed beneath the drains are continuously interchanged with empty buckets and the paint replaced in the circulating system throughout the painting operation.

The success of this painting method depends entirely on the control of the specific gravity of the paint. Paint is thinned to a consistency approaching water and specific gravities for each coat of paint are closely controlled in accordance with manufacturers' recommendations. The finished coat on our transformers is maintained at a specific gravity of 1.05. Best results are obtained when atmospheric temperatures are above 50 deg. F. and less than 90 deg. F.

All paint caught in the drip pans is returned to the circulating system and, following painting of one transformer, the paint is placed in closed containers and checked for gravity before again being used.

At our smaller substations, where the units are 2,000 kva. capacity, it will be possible to paint a total of two transformers each day. This probably represents the minimum amount of time that we can expect to attain in the use of this equipment, since the additional hours of the day will be required in the setting-up process and travel time to and from the substations. The amount of paint used approximates that used by the spray paint method and the paint surface dries to a mirror-like film, completely devoid of runs and curtains. The only brush work required in painting transformers of this type is that necessary to paint the top and bottom surfaces of the unit and remove the small amount of excess paint which collects at the bottom of the radiator tubes.

CONSULTING DEPARTMENT

Turntable Signals

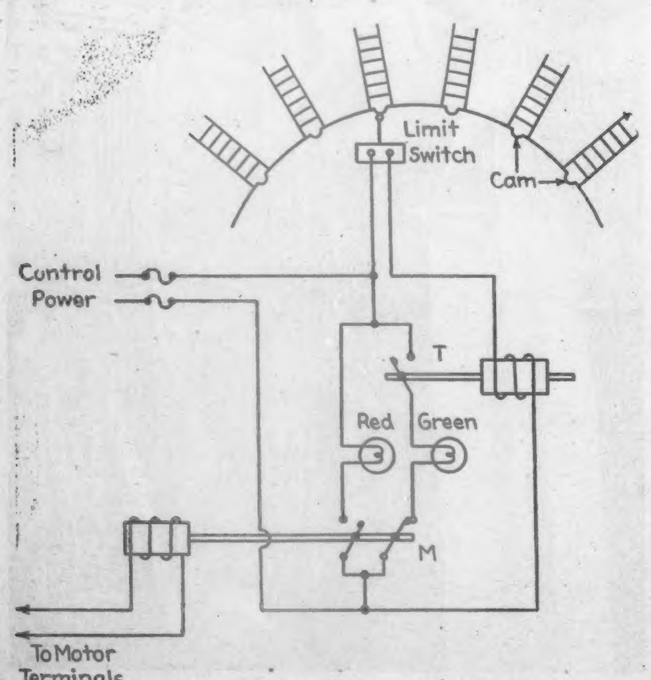
There is always the danger that a locomotive may be moved onto or off a turntable when the rails are not properly lined up. Can you suggest a system of signals or other means which will tell the hostler when the tracks are properly aligned?

Can you answer the following question? Suitable answers will be considered as contributions and will be published in a subsequent issue. If you have questions to ask, send them in also. Answers and questions should be addressed: Electrical Editor, *Railway Mechanical Engineer*, 30 Church street, New York.

Would it be practicable to mount passenger-car battery boxes on rollers to permit drawing the batteries out for flushing, cleaning and inspection?

Contact Device Would Give Needed Indications

There is always a difference of opinion about the advisability of adding gadgets to railroad equipment to prevent accidents, which at the moment may appear to be very remote. Nevertheless, when it comes to considering the possibility of having a busy turntable shut down, it does seem that every accident-preventing scheme should be given study. Especially is this important when we realize that turntables must operate day and night in all kinds of weather.



Circuit diagram for signal system

The sketch which forms a part of this answer, shows one possible method of using signal lights on a turntable. It requires two relays, a red signal lamp, a green signal lamp, one normally open limit switch, and the necessary wiring. One relay is equipped with a set of normal open contacts, and a set of normally closed contacts, while the other relay simply carries one set of normally open contacts. The coil of relay *M* (for motor) is connected directly across the terminals of the main turntable operating motor, and thus relay *M* will close its normally open contacts whenever the motor is energized. The relay *T* (for turntable) is energized through a normally open limit switch, which is closed by a cam surface which projects from the turntable pit wall. This cam surface will of course have to be located so as to close the limit switch when the turntable rails are properly aligned with the stationary rails.

From the diagram it will be evident that the red lamp will light whenever the turntable motor is energized. Thus a signal is given to all concerned that the turntable is moving, and that it is unsafe for a locomotive to move onto or off the table. It will also be evident that the green lamp will light when the turntable motor is not energized and when the limit switch is closed to indicate that the turntable is lined up with a set of stationary rails. Only one red and one green lamp have been shown on the diagram, but in many cases it will be advantageous to provide at least three sets of signal lamps. One set of these lamps may be located at each end of the table, while the other set may be placed in the cab near the controllers.

Emmet Matthews

NEW DEVICES

All-Plastic Safety Goggles

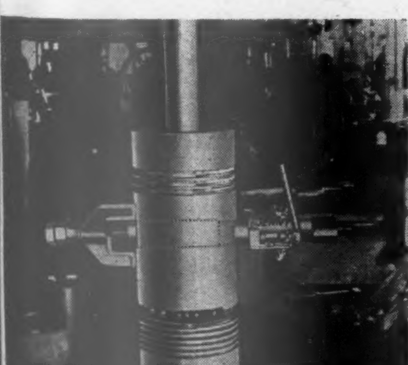
A lightweight safety goggle in which the lenses are made of one-piece construction from a plastic material which is shatterproof

Safety goggles in which the lens and frames are made of plastic materials

and highly resistant to pitting caused by sparks is produced by the Watchemoket Optical Company, Inc., Providence 3, R. I. A curved plastic frame fits the face snugly and affords eye protection from every angle. Lens replacement is said to be simple. These non-fogging goggles are also available in styles for wear over prescription glasses.

Hydraulic Puller

The Simplex Jenny Center-Hole Hydraulic Puller introduced by Templeton, Kenly & Company, Chicago 44, is adapted to pulling bushings, cylinder liners, pistons, wrist pins, valve seats, keys, wheels, sprockets, gears,



Puller being used to remove wrist pins from piston of a Diesel engine

boiler tubes and pipes. It can be employed to pull structural members together for welding or riveting. The unit pulls, pushes or lifts and it can be rigged up to serve as a portable press. It operates vertically or horizontally without heavy auxiliary equipment, and without side thrust or friction. It serves as its own back-up and is self-supporting because of its center-hole construction.

Five models are available, ranging from 30 to 100 tons in capacity. Three models have single pumps and the other two are equipped with high- and low-speed pumps which can be operated separately, alternately or together. The units are built of heat-treated alloy steels to withstand heavy loads and service abuse and all models are tested to a 50 per cent overload.

Small Capacity Hydraulic Presses

Gap style hydraulic presses of 10 and 20 tons capacity are being built to supplement larger equipment in big shops and for use in plants where larger capacity machines are not required. Both models have a 50

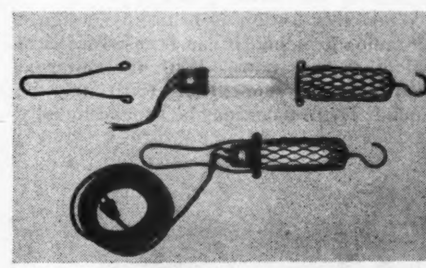
A small-capacity hydraulic press for miscellaneous shop operations

per cent overload capacity. They are of all-steel construction and have a two-lever hydraulic foot control. One applies pressure at controlled speeds and the other operates to release pressure and return the ram to normal position. The units are self air-eliminating and do not require bleeding.

There is a large hollow ram area for receiving punches, dies and other fixtures; the sealing rings are of the packless type and a pressure gauge can be supplied which shows the pressure in the system as well as the tons force at the ram. The presses are compactly built and are light enough in weight to be moved readily about a shop as conditions require. The manufacturer is Reimuller Brothers Company, Franklin Park, Ill.

Small Portable Light

A 40-watt portable lamp, measuring less than 2 in. in diameter and 14 in. in length, known as type 44-A, is now being offered by the Hoffman Company, York, Pa. One



Assembled and disassembled views of the Hoffman type 44-A portable light

side of the lamp is clear glass and the other has an aluminum finish which acts as a reflector but also transmits enough light to supply secondary illumination. The lamp guards, which are made of flat die-cut sheet steel, are formed to make a complete cylindrical guard around the lamp. The socket is weatherproof, the hook and handle are made of heavy wire and the cord is made in any length desired.

Grinding Fixture

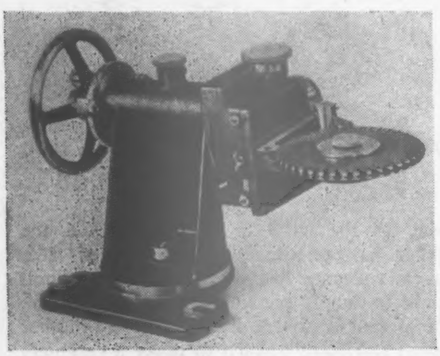
For profile grinding a 180 deg. radius or any lesser arc form on the teeth of milling cutters from 3 in. to 6 in. diameter and up to 1 in. thick, the Hill-Bartelt Machine Company, Rockford, Ill., has developed a new radius-grinding fixture for use on standard tool-grinding machines. The fixture is precision-built throughout and is provided with complete, easily-operated adjustments for quickly and accurately positioning the cutter for the desired radius and back-off angle.

The cutter is clamped so that it can be rotated on a plate extending from a head which has two micrometer-adjustable cross slides operating at right angles to each other. The head is carried on a shaft which is swung by hand through the desired arc, using a hand wheel on the other end of the shaft. The shaft bearing is at the top of a pedestal which can be swivelled to obtain the back-off angle. This pedestal is clamped to a base which has two slots by which it can be bolted to the grinder table.

By means of the micrometer adjusting screws on the two cross slides, the cutter can be accurately positioned so that the center of the arc to be ground will fall exactly along the axis of the shaft on which the head is rotated. A scale, marked in degrees, on the base of the pedestal provides accurate adjustment of the angle at which the tooth is presented to the grinding wheel, thus determining the back-off angle.

Indexing is manual, with a conventional adjustable spring finger stop. The arc through which the head is swung can be controlled by adjustable stops on a plate back of the hand wheel. Visual indication of the amount of swing is given by an arc scale on the back of the head. Thumbscrews are provided for clamping the cross slides in position, and adjustable wear gibs provide take-up of any looseness that may develop in the slides. A spring pin in the top of the shaft bearing will engage holes in the shaft to fix the cutter in either vertical or horizontal position.

While this fixture is primarily designed for radius grinding, it can be used for several other operations. With the cutter in fixed position, side-cutting teeth may be ground. Tooth faces may be ground radially



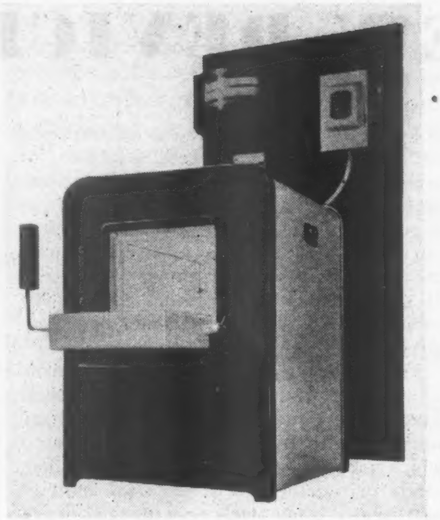
Radius-grinding fixture as used in re-sharpening a milling cutter

or with any desired hook or rake. A 90 deg. round corner of any radius up to ½ in. may be ground on cutter teeth. Other conventional grinding operations can be performed either before or after the radius grind, and without removing the cutter from the fixture.

Small Furnaces For Heat Treating

The Cooley Electric Manufacturing Corporation, Indianapolis, Ind., announces muffle furnaces for the heat treating of small parts, drawing, or tempering small lot runs, normalizing or annealing, preheating for subsequent high-speed hardening, and for emergency repair orders where one or two parts must be heat treated in a short time. These heat treating units may also be used effectively as auxiliary equipment to larger furnaces.

The outer shell of the furnace is of heavy gage steel and the frames are secured by through rods. Elements are of the embedded type which afford protection to the



Cooley muffle furnace and control panel

element wire from atmospheric attack. Four interlocking, rectangular elements form the interior of the chamber and replacement is a simple matter. The furnaces are automatically or hand-controlled, but the automatic control is recommended for more even heat treatment and better results.

For general industrial purposes, the electric heat treating furnace is offered in two sizes. These are the type MH-3, which has a chamber capacity 8 in. wide, 6 in. high, by 14 in. deep, having a maximum consumption of 3,400 watts, and the type MH-4 which has a chamber capacity 10 in. wide by 6 in. high by 18 in. deep and a maximum power consumption of 4,800 watts. Operating temperatures are 1,750 deg. F. for continuous and 1,850 deg. F. for intermittent operation. The type MH-3 operates on both 110-220 volt circuits, whereas type MH-4 is available for 230 volt circuits only.

Portable Balancing Equipment

Balancing equipment for rotating machinery is being offered by The Vibroscope Co., New York. The essential parts of the balancing equipment are a stroboscope, which consists of a flashing neon lamp, a breaker head to interrupt the circuit to the neon lamp once each revolution, and a vibrometer which indicates vibration amplitude. Application of the balancing equipment requires marking the rotating apparatus with numbers on its face or periphery to identify any point. The breaker head is applied to the end of the shaft of the rotor under a test. The vibrometer is applied to one side of the rotor bearing. The stroboscope makes the numbers on the rotor appear to stand still, and by moving the phase adjuster on the vibrometer, the number corresponding to the high spot on the rotor will appear adjacent to the vibrometer.

Davey portable balancing equipment

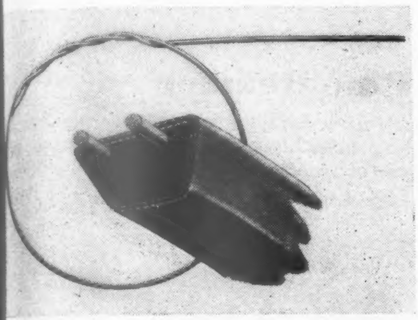
V-Belt Reinforced With Wire Grommet

An endless V-belt, adapted to many railway uses, such as axle generator, air-conditioning and Diesel-engine auxiliary drives, is now being marketed by the Chicago Railroad Supply Company, Chicago, the unique feature of which is the use of grommet-type reinforcing wires within the belt which make it exceptionally strong. In fact this is said to be the strongest V-belt, in proportion to its size and weight, ever made.

The grommet is made by forming wire cable into a loop and then winding it spirally on itself up to the needed size. It is

V-belt with grommet-type wire reinforcement

endless and two grommets are built into each V-belt near, and uniformly spaced from, the larger diameter. The wire grommet is spirally wound in one direction and covered with cord spirally wound in the other direction, thus tending to balance each belt. The wire used has a high tensile strength, preventing permanent stretch of



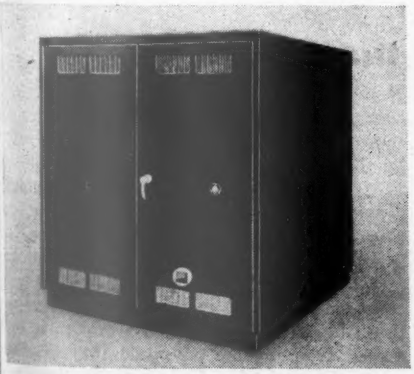
Construction of the Chicago endless wire-grommet V-belt

the belt under reasonable loads, but the twisted construction is said to give a certain amount of resiliency necessary in starting heavy loads.

The V-belt is supplied in five sizes: $1\frac{1}{2}$ in. by $\frac{11}{32}$ in.; $\frac{21}{32}$ in. by $\frac{7}{16}$ in.; $\frac{7}{8}$ in. by $\frac{17}{32}$ in.; $1\frac{1}{4}$ in. by $\frac{3}{4}$ in.; and $1\frac{1}{2}$ in. by 1 in. The pitch lengths vary from 26.9 in. to 129.1 in. for the smallest size and from 183.3 in. to 360 in. for the largest size.

Enclosed Air Circuit Breakers

Large air circuit breakers in individual metal enclosures, for heavy industrial service, are announced by the I-T-E Circuit Breaker Co., Philadelphia, Pa. These breakers (type LG) are available in ratings from



Front view of an indoor enclosed circuit breaker

2,000 to 10,000 amp., with interrupting ratings of 75,000 and 100,000 amp. Standard voltage ratings are 600 volts a.c. and 250 volts d.c. Operation may be either manual or electric.

The enclosures are built of heavy-gage bonderized, sheet steel and can be supplied for either indoor or outdoor service. Either type gives full protection for the circuit breaker, which may be opened or closed without opening the enclosure. Large doors at front and rear provide access to the breaker and the connection studs. Connecting cables may enter the enclosure at the top, bottom or sides.

All-Weather A.C. Welder

A.c. welders, made by Wilson Welder and Metals Co., Inc., New York, are now available in all-weather models of 300 and 500 amp. capacities. These machines are similar to the standard Wilson Bumblebee a.c. welders, except that they have special moisture-proof insulation throughout, and all parts are protected by a heavy coating of

Wilson a.c. welder for outdoor service

moisture-proof paint. The outer case is finished in a durable weather resisting enamel and has gaskets and louvers designed to prevent entrance of rain. In addition, the welder is equipped with a low-voltage contactor which automatically holds the open circuit voltage at approximately 40 volts. When the operator strikes the arc, the low voltage contactor closes instantly and the transformer's performance thereafter equals that of machines not similarly equipped. When the arc is extinguished, this device immediately reduces the voltage back to 40 volts. The machines are distributed by the Air Reduction Sales Company.

Instant-Starting Fluorescent Lamp

Development of an instant-starting 40-watt white Mazda fluorescent lamp has been announced by the General Electric Lamp Department, Nela Park, Cleveland, Ohio. It has the same rated life when operated with instant-starting ballasts as that of the present 40-watt fluorescent lamp which is started by means of the conventional switch, and by "preheating." Limited quantities of the instant-starting lamp will be available for shipment, on and after May 1, for war production installations equipped with instant-starting ballasts. It will bear special marking to permit easy identification.

Instant starting, the lighting experts at Nela Park point out, has been taken more or less for granted by the consuming public because of the instantaneous starting of filament type lamps. Addition of this feature to the numerous advantages of standard fluorescent lamps since their inception will, it is believed, greatly increase the acceptance of fluorescent lighting.

Statite Dust Guard

A dust guard, known as the Statite, recently placed on the market by the Lubrication Products Company, Cleveland, Ohio, is said to give positive protection against the infiltration of water and dirt into journal boxes and to prevent the loss of oil from the box.

This dust guard consists of a sturdy frame *1*, or backbone, made of heavy-gage steel designed to withstand any pressures which may be placed on it, including jacking the journal box when frozen. The laminated gasket *2*, made of two layers of high-grade wool vulcanized to a layer of oil-and-water proof Neoprene, serves as a close-hugging,

Statite dust guard

free-sliding gasket or collar on the journal. It also serves as a soft cushioning gasket which forms a seal against the relatively rough cast-iron surface of the dust-guard well.

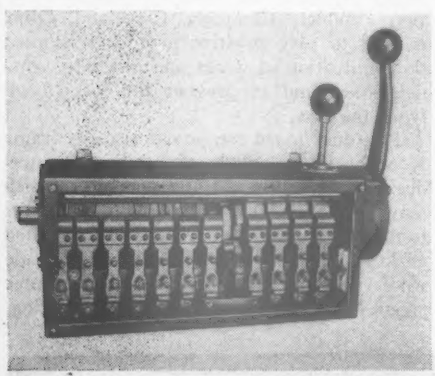
The springs *3* hold the entire assembly in place and exert sufficient force to hold the gasket tightly against the face of the dust-guard well. The adjustable top *4*, with its soft felt gasket, slides up and down so that it can be tightly and firmly closed against the top edges of the well when the dust guard is installed but at the same time can be used as a handle, when removing the assembly, by lifting up to the limit of its guides.

The Statite dust guard is easy to install and made in standard sizes to fit all standard A. A. R. journal boxes. The gasket

material is said to have been used as oil seals on roller and ball bearings for several years where it showed no deterioration from contact with either oil or water and gave reliable service over a long period.

Battery Saving Controller

Economy in current consumption is indicated as the significant feature of the M-79 simplified four-speed reversing controller for electric and gas-electric trucks manufactured by The Elwell-Parker Electric Company, Cleveland, Ohio. Experience in operation under war conditions has shown that when motor current is restricted by

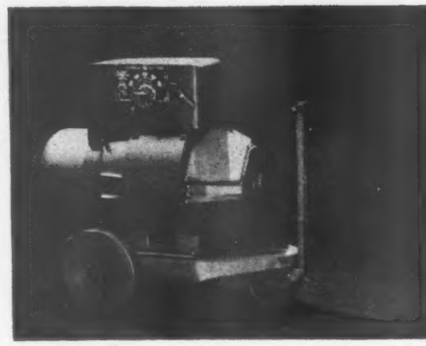


Elwell-Parker type M-79 controller for electric and gas-electric trucks

introducing resistance on first, second and third speeds, a wasteful amount of current can be consumed by running the truck for protracted periods on any of these three speeds. The major portion of this possible waste of current is prevented by the new controller, which uses resistance on the first speed only. An additional power saving is effected by connecting the motor fields in series on first and second speeds, which produces greater torque with less current consumption. The welded housing of the controller is dust tight and meets all specifications for flash-proofing. The controller is now used on all Elwell-Parker electric or gas-electric low- and high-lift trucks in capacities up to 10,000 lb.

Improved D.C. Welders

Improvements in its line of d.c., single-operator arc welders, type WD-30 series, have been announced by the electric welding division of the General Electric Company, Schenectady, N. Y. The welders are now equipped with two new control dials and a redesigned driving motor. The control dials permit the welding current to be preset without the aid of a volt-ammeter, and the driving motor is designed to give exceptional resistance to the weather when the welding machine is operated outdoors. One of the control dials is calibrated in terms of electrode size. The other dial



Dials may be preset for electrode size and welding current

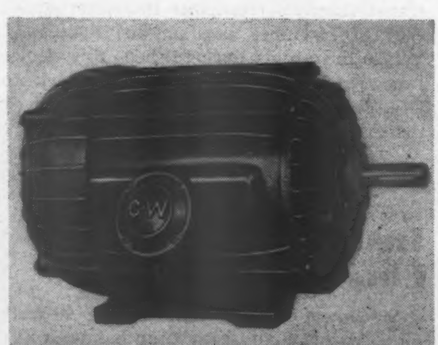
indicates the range of welding current available for use under these conditions.

While basically the driving motor is the same as that previously furnished with these welders, it is equipped with heavier insulation and has special weather-protective features. Enlarged intake openings for ventilating air keep the air velocity low enough to prevent rain and snow from being drawn in, while a large baffle back of the openings prevents water from splashing into the motor. The insulation of the motor windings is very heavy, and accelerated life tests show that this new insulation is far more resistant to deterioration from salt spray than insulation previously used.

Corrosion Resistant Motor

The Crocker-Wheeler Division of the Joshua Hendy Iron Works, Ampere, N. J., announces the release of a corrosion resistant motor. This motor is suitable for operation in atmospheres containing injurious dusts, corrosive vapors or gases, and excessive moisture.

Available in sizes from one to fifteen horsepower, the motor can be furnished for operation from any polyphase power supply. It is of the totally enclosed, fan-cooled type, but the design departs from previous models in that there are no cooling



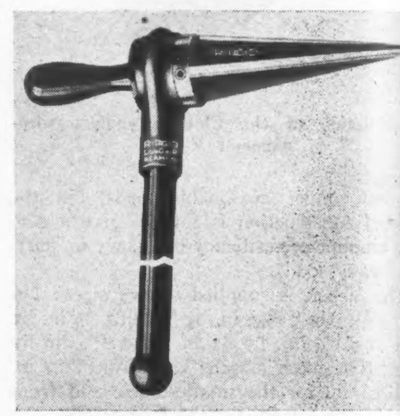
The motors are available, as polyphase units, in sizes from one to fifteen horsepower

ducts to become fouled with wet or sticky dusts. All exposed parts of the motor are acid- and alkaline-resistant to a high degree.

In laboratory tests the motor was operated on an intermittent cycle while drenched in water for forty-eight hours without failure. In a second test, fine chalk was introduced into the test chamber for several hours without penetration into the motor. In addition to the mechanical sealing of the entire motor, each coil is individually sealed against moisture, fumes, vapor and dust by the vacuum impregnation process.

Pipe Reamer

A reamer for pipe which has an unusually long taper design has been added to the line of such tools distributed by the Ridge Tool Company, Elyria, Ohio. The long



The extra long taper design of this reamer aids in preventing flaring or splitting when pipe is being reamed

taper is said to be effective in avoiding flaring, splitting or reduction in wall thickness while removing burrs cleanly and easily from the inside of pipe or conduit. It is furnished with a ratchet handle or can be used with handles to certain other tools of this company's manufacture.

Dust Collectors

Self-contained dust-collector units for a variety of needs have been added to the line of such equipment being manufactured by the Pangborn Corporation, Hagerstown, Md. Sturdily built for long-life, heavy-duty service, the units consist of two major sections—a preliminary centrifugal section and a secondary cloth-screen section. Dust enters the centrifugal section where, due to a rotation in air velocity and centrifugal action, the bulk of entrained material is separated from the air stream. The air, then containing only fine dust particles, flows upward to the screen section where the fine dust is filtered out. The cleaned air passes to the exhauster and is discharged.

The cloth-covered filter screen frames are provided with a shaking device which is operated at intervals, with the exhauster shut down, to free the cloth surfaces from collected fine dust. This dust, together with that precipitated by the preliminary centrifugal action, is deposited in the common dust drawer for removal. The units are available in three sizes with capacities to 1,000, 2,000 and 3,000 c. f. m.

NEWS

Association Meetings

MECHANICAL DIVISION, A. A. R.

THE annual meeting of the Mechanical Division, Association of American Railroads will be held at the Jefferson Hotel, St. Louis, Mo., on June 23 and 24.

COORDINATED MECHANICAL ASSOCIATIONS

AT a conference of officers of the Coordinated Mechanical Associations at Chicago on March 20, it was decided to hold the next annual meeting of these Associations on September 26, 27 and 28 at the Hotel Sherman, Chicago. The Associations involved include the Railway Fuel & Traveling Engineers' Association, The Master Boiler Makers' Association, The Car Department Officers' Association and the Locomotive Maintenance Officers' Association.

At the joint opening meeting on the morning of September 26, a prominent railway officer will deliver the principal address after which the Associations will adjourn to individual meeting rooms for the presentation of their respective programs. Full member meetings are scheduled but without exhibits or entertainment.

Transportation Equipment Division of WPB Has New Home

THE Transportation Equipment Division of the War Production Board is now located in Temporary Building E, Fourth street and Adams drive, S. W., Washington, D. C.

Battley Appointed Member of A.S.M.E. Committee

E. R. BATTLEY, chief of motive power and car equipment, Canadian National, at Montreal, has been appointed a member of the Technical Committee on Locomotives (Railroad Division), American Society of Mechanical Engineers. The committee consists of 10 members of outstanding trainmen, and Mr. Battley, for more than 40 years with the mechanical department of the C. N. R., is regarded as one of Canada's authorities on railway motive power.

Joseph B. Eastman

JOSEPH BARTLETT EASTMAN, director of the Office of Defense Transportation since its inception late in 1941 and a member of the Interstate Commerce Commission since February 17, 1919, died of a coronary occlusion on March 15 in a Washington, D. C., hospital where he had gone on February 19 under orders from physicians. Mr. Eastman was born at Katonah, N. Y., on June 26, 1882. He received the degree of B.A. at Amherst College in 1904 and was honored with the degree of Doctor of Laws at Amherst in 1926; at Temple and at Syracuse Universities in 1934, and at Oberlin College in 1938. He became a member of the Massachusetts Public Service Commission in November, 1915, and was chairman of the Interstate Commerce Commission from July 1, 1939, until his appoint-

J. B. Eastman

ment as director of ODT in 1941. Mr. Eastman was Federal Coordinator of Transportation from June 16, 1933, until June 16, 1936.

Miscellaneous Publications

STEEL PLATE STANDARDS.—American Standards Association, 29 West Thirty-ninth street, New York 18. Specifications formulated by the American Society for Testing Materials as American Standards. Price, 25 cents each. The first standard, Low - Tensile - Strength Carbon-Steel Plates of Flange and Firebox Qualities (G30.1-1943) (ASTM A89-43), covers two grades of carbon-steel plate which is suitable for fusion welding and, if certain given requirements are met, for forge welding. The second standard, Carbon-Silicon Steel Plates of Ordinary Tensile Ranges for Fusion-Welded Boilers and Other Pressure Vessels (G31.1-1943) (ASTM A201-43), covers carbon - silicon - steel plates in two ordinary tensile-strength ranges, designated grades A and B, intended particularly for fusion welding and for use in locomotive boiler shells, boilers for stationary service, and other pressure vessels. The third standard, Low - Tensile - Strength Carbon - Steel Plates of Structural Quality for Welding (G40.1-1943) (ASTM A78-43), covers two grades of carbon-steel plates of a structural quality suitable for welding and, if certain specified requirements are met, for forged welding.

Young Named Acting Director, ODT

BRIG. GEN. C. D. YOUNG, heretofore deputy director of the Office of Defense Transportation, has been named acting director of ODT until a permanent successor to Joseph B. Eastman is appointed.

Williams A. A. R. Adviser on Technical Research

THE Association of American Railroads has engaged Clyde Williams, director of the Battelle Memorial Institute at Columbus, Ohio, as technical consultant to advise the railway industry on research matters.

Mr. Williams will make a study of the railroads' technical problems with a view to coordinating and organizing research relating to technological methods and processes. His office will be at 59 East Van Buren street, Chicago.

Experienced in industrial research, Mr. Williams has had much to do with the organization and conduct of investigations now being carried on in different industries, and he is chairman of the War Metallurgy Committee which is advising the War Production Board and other war agencies of the government.

ODT Promotion

E. R. HAUER has been appointed associate director of the Division of Railway Transport, Office of Defense Transportation, with direct supervision of all mechanical operations, succeeding Charles J. Wolfe. Mr. Wolfe, at the request of the Western Maryland, is returning to his former position of chief mechanical officer of that road, after a leave of 18 months.

Mr. Hauer joined the ODT staff early in 1942, and held the post of assistant director of the division in charge of controlled materials in the mechanical section when promoted. He entered the employ of the Chesapeake & Ohio in 1907, and held various positions in that road's mechanical department. In 1936 he was appointed engineer of motive power of the Advisory Mechanical Committee of that road, the Erie, Pere Marquette, and New York, Chicago & St. Louis.

National Security Award Won by Union Pacific Shops

THE Union Pacific shops at Ogden, Utah, and at Salt Lake City have been granted the National Security Award by the Office of Civilian Defense for superior achievement in plant security organization. The award was established by OCD to give public recognition to plants and facilities that have achieved outstanding programs of protection of their plant structures, personnel, and production processes against air

raids, fires, sabotage, explosions, and similar hazards. To qualify for the award, plants must not only establish an outstanding security and protection organization within the plant, but must also integrate their plant organization with the Civilian Defense units of the whole community.

American Railway Car Institute

EDWIN HODGE, JR., president of the Greenville Steel Car Company, has been elected president of the American Railway Car Institute to succeed J. F. MacEnulty, president of the Pressed Steel Car Company, who had held that office for the past ten years. R. A. Williams, vice-president of the American Car and Foundry Company, was elected an official of the Institute to succeed the late W. E. Hedgcock.

Edwin Hodge, Jr.

Mechanical Division, A. A. R.

FREIGHT-CAR FLOORS ARE DEFECTIVE

A JOINT circular letter, issued under date of February 25 by the secretaries of the A. A. R. Operating and Mechanical Divisions, states that the railroads are faced with a serious situation brought about by commodities falling through the floors of freight cars onto the track and, in some instances, causing derailments. This hazard is further increased by the character of the commodities being carried in connection with the war effort.

Reports received regarding these accidents and near accidents indicate that failures of the car floors are due to the following conditions; (1) Floor defects which existed before the car was loaded; (2) defective condition of those parts of the car which support or reinforce the floor; (3) flooring of insufficient strength to support the commodity loaded in the car, particularly that portion of the floor which is not reinforced with floor supports between the center and side sills; (4) defects caused by lift trucks used by the shipper in loading the car; (5) insecure blocking and bracing, which permits vertical vibration of the individual units when the load becomes loose.

The Operating and Mechanical Divisions recommend the following action:

Equipment assigned for loading commodities of a character placing concentrated weight on individual floor boards should be selected by those having a knowledge of the commodity to be loaded, as well as of car construction and loading and bracing methods.

Close inspection of equipment at all inspection points to locate indications of failure of flooring or floor supports before the failure actually occurs.

A more detailed supervision of loading practices and methods for blocking and bracing the load at point of origin.

Consideration be given to the application of substantial floor supports between the center and side sills and extending from end sill to end sill as cars receive general repairs.

The flooring of freight cars in general to be maintained in better condition.

REPACKING PASSENGER-CAR JOURNAL BOXES

In a circular letter dated February 25, the secretary of the A. A. R. Mechanical Division reports that in too many instances journal boxes on passenger-equipment cars are not being repacked after six months' service, as indicated by the stenciling and as required by Passenger Car Interchange Rule 7. Passenger cars, including railroad equipment, troop sleepers and troop kitchen cars, are being found in troop movements with journal boxes long overdue for this service, which many times results in delay to passenger-train movements on account of the journals running hot.

Since these cars are widely scattered, it is impossible for the car owners to take care of this service. It is urged, therefore, that proper instructions be issued to all mechanical forces to provide for properly repacking jounal boxes on this equipment at the expiration of six months, as required by the Interchange Rules, when such equipment is not in loaded movement and facilities are available for performing this service.

GEARED HAND BRAKES

Following the adoption of specifications for geared hand brakes by letter ballot last year, the various manufacturers of geared hand brakes were invited to submit their brakes for test and make application for certificate of approval. As of February 18, the secretary of the A. A. R. Mechanical Division announces that satisfactory tests have been conducted and certificates of approval awarded by the Committee on geared hand brakes to the following manufacturers: Ajax Hand Brake Company, Type Designation Drawing 14038; Champion Brake Corporation, Dwg. 1148; Champion Brake Corporation, Dwg. 1124; Klasing Hand Brake Company, Dwg. D-959; W. H. Miner, Inc., Pattern D-3290-X; Superior Hand Brake Company, Dwg. 566; Universal Railway Devices Company, Dwg. 4885; Universal Railway Devices Com-

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A specially designed chair set up in the North Station of the Boston & Maine at Boston, Mass., to determine standard dimensions for the "coach seat of the future" —Through a series of measurements to be obtained in four-minute tests of each of 3,000 passenger participants, it will be determined what seat height, length, breadth and distance from the floor best provides a "maximum of comfort for the majority of individuals" —The tests are being conducted jointly with Harvard University and the Heywood-Wakefield Company, Gardner, Mass.

pany, Dwg. 5550; Universal Railway Devices Company, Dwg. 5700. This supersedes the list appearing in a circular letter dated January 3, 1944, given on page 97 of the February issue of the *Railway Mechanical Engineer*.

Orders and Inquiries for New Equipment Placed Since the Closing of the March Issue

Locomotive Orders

Road	No. of Locos.	Type of Loco.	Builder
Alton	10[1]	Diesel-elec. sw.	American Loco. Co.
Chesapeake & Ohio	15[2]	2-6-6-6	Lima Loco. Wks.
Central of New Jersey	5	Diesel-elec. sw.	American Loco. Co.
	5	Diesel-elec. sw.	Baldwin Loco. Wks.

Locomotive Inquiries

Road	No. of Locos.	Type of Loco.	Builder
Tennessee Central	4	2-8-2 or 2-8-4	

Freight Cars

Road	No. of Cars	Type of Car	Builder
Central of Georgia	10	70-ton hopper	American Car & Fdry. Co.
	650[3]	50-ton box	Pullman-Standard
	100[3]	50-ton hopper	Pullman-Standard
	450[3]	50-ton box	American Car & Fdry. Co.
Chesapeake & Ohio	2,500[4]	50-ton hopper	American Car & Fdry. Co.
	1,250[4]	50-ton hopper	General Amer. Trans. Corp.
	1,250[4]	50-ton hopper	Pullman-Standard
Delaware, Lackawanna & Western	350	50-ton box	Magor Car Corp.
	250	50-ton box	American Car & Fdry. Co.
Erie	600	50-ton hopper	Greenville Steel Car Co.
Minneapolis & St. Louis	500	50-ton box	General Amer. Trans. Corp.
Nashville, Chattanooga & St. Louis	200	Hopper	Pullman-Standard
New York, New Haven & Hartford	2,500	50-ton box	Pullman-Standard
Southern	1,000	50-ton box	Mt. Vernon Car Mfg. Co.

Freight-Car Inquiries

Road	No. of Cars	Type of Car	Builder
Bangor & Aroostook	35	50-ton hopper	
Chicago & North Western	2,000	50-ton box	

Passenger-Car Orders

Road	No. of Cars	Type of Car	Builder
Louisville & Nashville	20[5]	Coaches	American Car & Fdry. Co.
	4[5]	Tavern-lounge	American Car & Fdry. Co.
	4[5]	Dining	American Car & Fdry. Co.

[1] To cost approximately $785,000.

[2] To cost approximately $4,200,000. Deliveries scheduled to start next September. Ten other Allegheny engines ordered in May, 1943, will be completed at Lima during the next four or five months. The combined overall length of one of the new engines and tenders is approximately 113 ft., and the combined weight of engine and tender in working order is 1,152,000 lb. The tender has a capacity of 25 tons of coal and 25,000 gals. of water. The locomotives are reported capable of a sustained speed of 70 miles an hour.

[3] Orders unconfirmed.

[4] Equipment to cost approximately $13,000,000. Deliveries scheduled to begin in the third quarter of this year.

[5] Awaiting WPB authority. The cars will be of aluminum construction with anodized aluminum sides. Cost estimated at about $2,000,000.

* * *

Emergency Journal Bearings Altered and Continued

In a circular letter dated March 4 Secretary A. C. Browning of the Mechanical Division, A. A. R., announces the continuance of the emergency design of journal bearing because of the lack of a sufficient supply of suitable scrap and journal brass to return to the former standard design of bearing recommended by the General Committee without the use of additional tin and copper. This is in conformity with a request of the Transportation Equipment Division of the War Production Board. Two dimensions of the emergency bearing (H and P) have each been increased 1/16 in. for all future emergency bearings. This increase in the thickness of the back will permit relining of these bearings and thus conserve critical material.

Diesel Engine Manufacturers Association

Harvey T. Hill has been appointed executive director of the Diesel Engine Manufacturers Association which has opened headquarters at 1 North LaSalle street, Chicago. For the past several years Mr. Hill has been secretary-manager of the Chicago Association of Credit Men. Robert E. Friend, president of the Nordberg Manufacturing Company, is president of the Diesel Engine Manufacturers Association; Gordon Lefebvre, president of the Cooper-Bessemer Corporation, is vice-president; and Robert H. Morse, Jr., general sales manager of Fairbanks, Morse & Co., is treasurer.

Program Contemplates Complete Dieselization of G. M. & O.

In his annual report to the stockholders, J. B. Tigrett, president of the Gulf, Mobile & Ohio, stated that the board of directors

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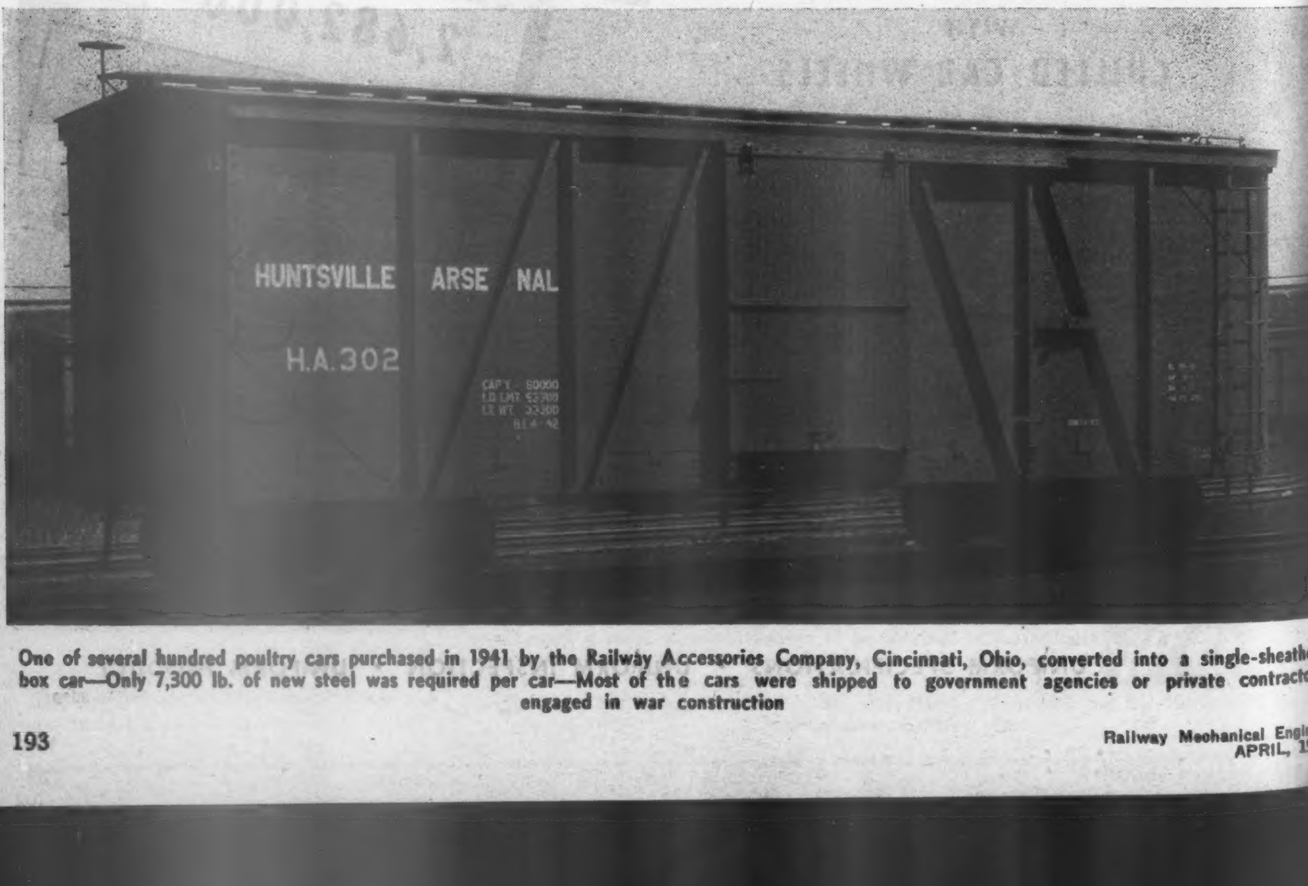
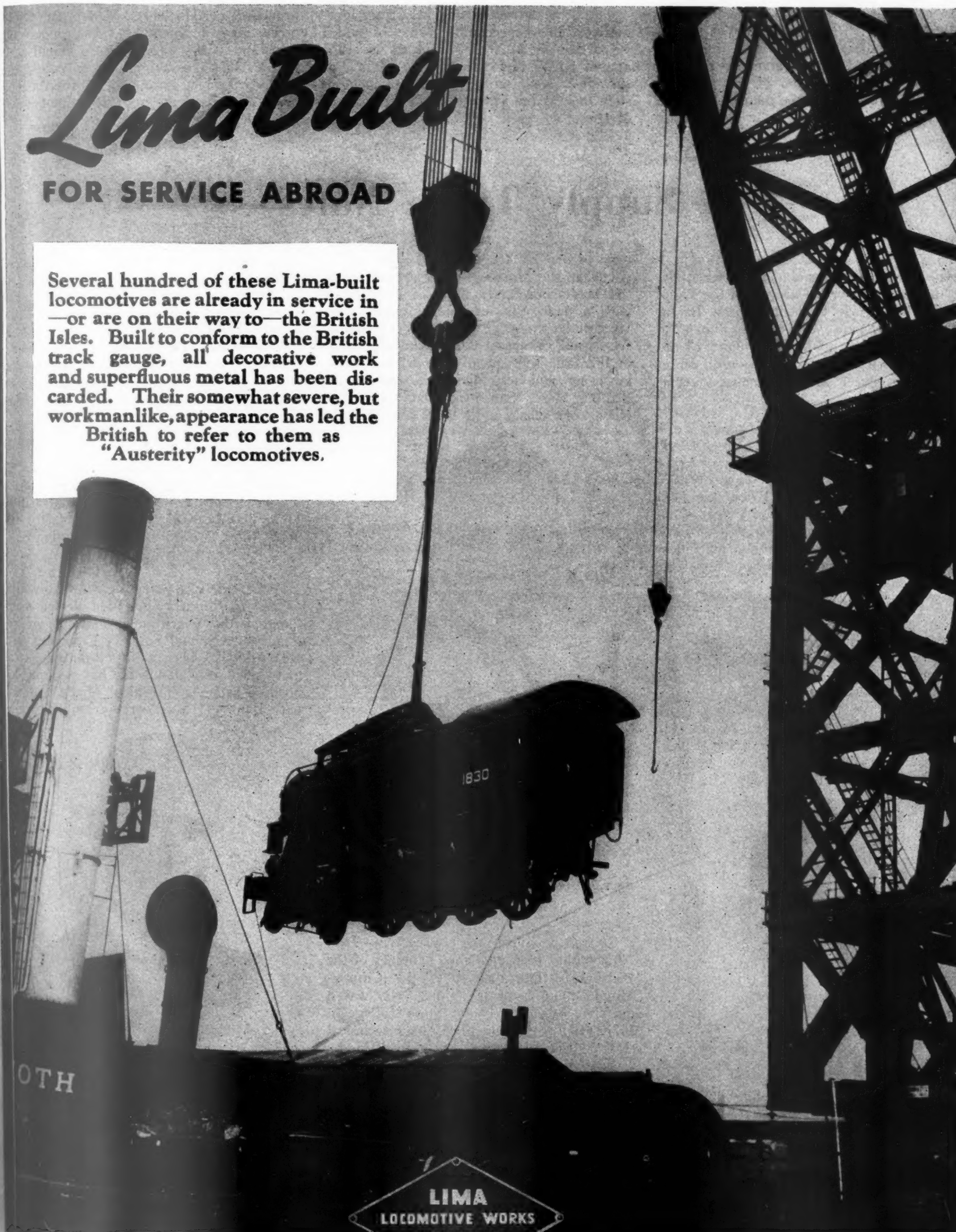


One of several hundred poultry cars purchased in 1941 by the Railway Accessories Company, Cincinnati, Ohio, converted into a single-sheathed box car—Only 7,300 lb. of new steel was required per car—Most of the cars were shipped to government agencies or private contractors engaged in war construction



LIMA LOCOMOTIVE WORKS, INCORPORATED, LIMA, OHIO

has under consideration a program for the complete Dieselization of the railroad's motive power. Preliminary studies are reported to indicate that savings of between $800,000 and $1,000,000 annually could be effected after completion of the program. The estimated cost of the number of Diesel units needed to handle the traffic expected following cessation of the war is $9,000,000.

The company now owns 151 steam locomotives, the depreciation value of which is carried at $1,209,788, and the average age of which is 25 years. The re-sale or salvage value of the present equipment at such time as the railroad could get delivery of Diesel power is said to be nominal. Mr. Tigrett said that the railroad has been promised certain units of freight Diesel power for experimental purposes about mid-year, and, if this equipment, in actual service, develops the savings and operating efficiency expected, arrangements for the purchase of part of the needed equipment will be made.

Supply Trade Notes

Baker-Raulang Company.—*Henry S. Haight* has been appointed representative in the state of North Carolina of the Baker Industrial Truck Division of the Baker-Raulang Company, Cleveland, Ohio. Mr. Haight operates under the name of the Haight Engineering Company, with offices at Moore street and Altamount avenue, Richmond, Va.

◆

Vulcan Iron Works.—*Joseph F. O'Brien* has been appointed assistant to the president of the Vulcan Iron Works, Wilkes-Barre, Pa. Mr. O'Brien began his career as an apprentice in the Vulcan shops more than 30 years ago. *Ralph O. Smith*, formerly in charge of mining machinery sales for the company, has been appointed general sales manager.

◆

Westinghouse Air Brake Company.—*S. L. Poorman*, eastern manager of the Westinghouse Air Brake Company, whose promotion to assistant to the first vice-president was reported in the March issue, joined the Westinghouse Company in 1912 as an apprentice in the engineering department. During the following thirty years of his association with the company, Mr. Poorman served successively as mechanical engineer and representative in the southeastern district and representative and manager in the eastern district. He was appointed eastern manager with headquarters at New York in 1938. His new headquarters will be at the company's general office in Wilmerding, Pa.

S. L. Poorman

S. L. Williams, assistant manager for the eastern district, whose appointment as manager to succeed Mr. Poorman was also reported in the March issue, is a graduate of the Massachusetts Institute of Technology with a degree in mechanical engineering. He entered the service of the Westinghouse Air Brake Company as a special apprentice in 1923 and subsequently served in the engineering and test divisions, and in the Boston, Mass., San Francisco, Calif., and New York offices until 1930, when he was appointed district engineer of the eastern district. He was appointed assistant manager, eastern district, in 1941.

S. L. Williams

◆

Climax-Molybdenum Company. — *John F. Robb* has been appointed manager of the Pittsburgh, Pa., district of the Climax-Molybdenum Company. Mr. Robb was a graduate of Pennsylvania State College in 1927. Before joining the Climax technical staff in the Pittsburgh office in 1935, he was associated successively with the Carpenter Steel Company, the Birdsboro Steel Foundry & Machine Co., the Pittsburgh Crucible Steel Company, and the Brighton Electric Steel Casting Company.

Army-Navy "E" Awards

Edward G. Budd Manufacturing Co., Philadelphia, Pa. Third award.

Cochrane Corporation, Philadelphia, Pa.

Handy & Harman, New York. Fourth award.

Philco Corporation, Trenton, N. J. Fourth award.

Silent Hoist & Crane Co., Brooklyn, N. Y. Third award.

Pittsburgh Plate Glass Company.—*William T. Carey* has been appointed to fill the newly-created position of director of sales, transportation finishes, for the Pittsburgh Plate Glass Company, with headquarters in Pittsburgh, Pa. Mr. Carey was the company's railway paint sales representative in the St. Louis, Mo., territory from 1928 to 1935, and subsequently held a similar position in the Chicago territory.

◆

Tyson Bearing Corporation.—*John K. Colgate*, vice-president and treasurer of the Tyson Bearing Corporation, Massillon, Ohio, has been elected president, to succeed *Ralph Maxson*, who has resigned.

◆

American Car and Foundry Company.—*John E. Rovensky* has been elected chairman of the executive committee of the American Car and Foundry Company. Mr. Rovensky has been a director of the company since July, 1940. He has resigned his position as a vice-president of the National City Bank of New York, in order to give full time to his new duties. *Walter J. Cummings*, chairman of the board of the Continental Illinois National Bank & Trust Co., of Chicago, also has been elected a member of the executive committee. *W. Lyle Richeson* has been appointed assistant vice-president, sales department, and *William R. Kottsieper*, assistant manager of sales of the valve department, of the American Car and Foundry Company, has been appointed manager of that department. *W. A. Gormley*, a member of the valve department, has been appointed sales manager of a.c.f. valves, and *L. A. Ward*, also a member of

William R. Kottsieper

(*Continued on next left-hand page*)

FUEL

a strategic material

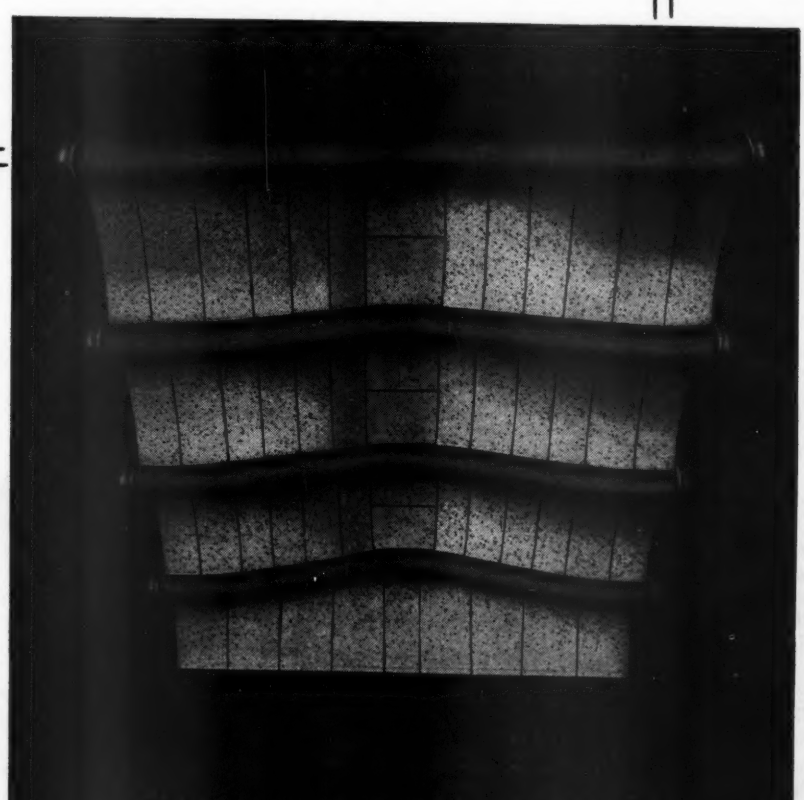
CONSERVED

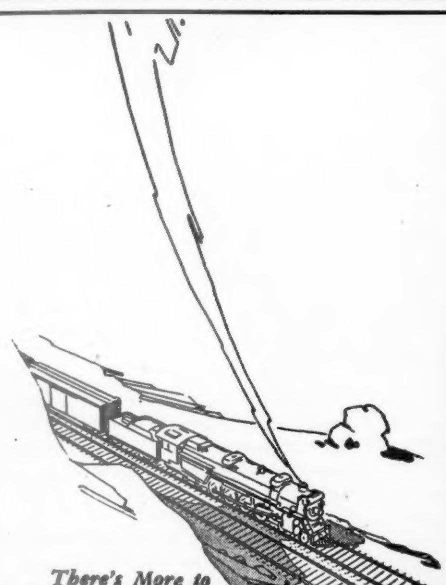
with Security Sectional Arches

Today, more than ever, fuel is one of our strategic materials. Making every pound of fuel produce the maximum amount of steam not only conserves this strategic material but also the cars required to transport it.

For over 33 years, Security Sectional Arches have been saving fuel on all types of steam locomotives.

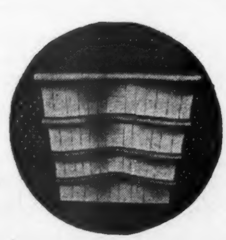
But experience has proved that only with a *complete* Arch can maximum fuel economy be realized.





HARBISON-WALKER REFRACTORIES CO.

Refractory Specialists



AMERICAN ARCH CO.
INCORPORATED
60 EAST 42nd STREET, NEW YORK, N. Y.

Locomotive Combustion Specialists

the valve department, has been appointed assistant sales manager.

W. Lyle Richeson was a graduate of the Sheffield Scientific School of Yale University in 1924. He began his career with the company at the Berwick, Pa., plant in 1925, and was transferred to the New York

W. Lyle Richeson

office as sales agent for the miscellaneous sales department in 1926. He was appointed district sales agent at the Cleveland, Ohio, office in 1930, and later district sales manager of that office. He returned to the company's New York office in 1937.

William R. Kottsieper has been associated with the company for 38 years. He began his career in the auditing department of the company's St. Louis, Mo., office and was transferred to the operating department of the New York office in 1918. When the American Car and Foundry Company began the production of valves in 1931, he assisted in organizing the valve department, and was appointed assistant manager of sales.

◆

INDEPENDENCE PNEUMATIC TOOL COMPANY.—*Neil C. Hurley*, president of the Independent Pneumatic Tool Company, has been elected chairman of the board. *Neil C. Hurley, Jr.*, executive vice-president, succeeds the elder Neil C. Hurley as president.

Neil C. Hurley, Jr., immediately after his graduation from the University of Notre Dame in 1932, entered the employ of Independent as advertising manager. In 1934 he became manager of the electric tool division and in 1936, secretary. In 1939 he was elected vice-president and in 1943, executive vice-president.

◆

CLIMAX MOLYBDENUM COMPANY.—*Paul M. Snyder* has been appointed sales manager of the Climax Molybdenum Company, with headquarters at Canton, Ohio. Mr. Snyder has been in charge of the company's sales and development work in the Canton area since March, 1932.

◆

B. F. GOODRICH COMPANY.—*Chester F. Conner*, formerly merchandise manager, has been appointed assistant general manager and *Fred Lang*, formerly manager of sole and heel sales, has been appointed merchandise manager, of the industrial products sales division of the B. F. Goodrich Company.

EDGEWATER STEEL COMPANY.—*T. E. Marston* has been appointed manager of ring sales for the Edgewater Steel Company, Pittsburgh, Pa.

◆

SCHAEFER EQUIPMENT COMPANY.—*James H. Shaffer*, special representative of the Schaefer Equipment Company, has been appointed manager of sales, with headquarters at Pittsburgh, Pa. *W. Tom Ashe*, formerly eastern representative and office manager in New York of the Chicago Railway Equipment Company, has joined the Schaefer Equipment Company as assistant sales and service manager with headquarters in New York.

◆

AMERICAN STEEL & WIRE COMPANY.—The American Steel & Wire Co., subsidiary of the United States Steel Corporation, has created two separate divisions to handle the sale of electrical products and wire rope and construction materials. *P. T. Coons*, formerly head of the electrical, wire rope and construction materials department, which has been discontinued, and *B. M. Ashbaucher*, a correspondent in that department, have been appointed manager and assistant manager, respectively, of the wire rope and construction materials division. *T. F. Peterson*, director of electrical cable engineering and research, and *C. H. Eisenhardt*, formerly assistant manager of the electrical wire rope and construction materials department, have been appointed manager and assistant manager, respectively, of the new electrical division.

◆

FARRELL-CHEEK STEEL COMPANY.—*T. D. Moore*, sales engineer of the Farrell-Cheek Steel Company, Sandusky, Ohio, has been

T. D. Moore

appointed manager of the newly-created railway division. Mr. Moore was born in Sandusky, Ohio in 1905. He entered the employ of the Farrell-Cheek Steel Company in 1923 and during the 21 years has had progressive promotions in the shipping, production, sales and engineering departments. Since 1929 he has been sales engineer directing the company's contacts with a number of railroad and railroad equipment builders.

◆

AMERICAN CHAIN & CABLE COMPANY.—*Alton Parker Hall*, assistant manager of sales of the New York office of the Bethlehem Steel Corporation, has been appointed assistant general manager of sales of the American Chain & Cable Company, with headquarters in New York. During the first world war, Mr. Hall served as an officer in the field artillery reserve corps of the Army. He was a graduate of Princeton University in 1922 when he joined the Bethlehem Steel Company. He subsequently served in the operating and sales departments and was appointed assistant manager of sales of Bethlehem's New York office in 1938.

◆

BALDWIN LOCOMOTIVE WORKS.—*C. E. Kraehn* has been appointed assistant to the vice-president in charge of sales activities of the Baldwin Locomotive Works. Mr. Kraehn was a graduate of the Rensselaer Polytechnic Institute in 1918. He served as a commissioned officer in the U. S. Navy during the world war and in 1919 joined the General Electric Company, at Schenectady, N. Y. He was transferred to the New York

C. E. Kraehn

district office in 1922, where he served in various sales capacities until 1937 when he was assigned to the company's Boston, Mass., office. Mr. Kraehn was transferred to the International General Electric Company in New York in 1942 and in 1943 he resigned to join the Baldwin Locomotive Works.

◆

TALON, INC.—*Robert A. Campbell*, assistant sales manager of the Ohio Seamless Tube Company, has been appointed sales manager of the steel tube division of Talon, Inc.

◆

PHILADELPHIA STEEL & WIRE CORPORATION.—*Stanley H. Smith*, manager of railway sales of the Philadelphia Steel and Wire Corporation, Philadelphia, Pa., has been elected vice-president. Mr. Smith will continue to serve as president of Stanley H. Smith & Co., Cleveland, Ohio, and as vice-president of Eastern Railway Supplies, Inc., New York.

◆

H. K. PORTER PURCHASES MT. VERNON CAR MANUFACTURING COMPANY.—The H. K. Porter Company, Pittsburgh, Pa., has purchased the Mount Vernon Car Manufacturing Company, and its subsidiary, the J. P. Devine Manufacturing Company, both

ith plants at Mt. Vernon, Ill. The J. P. evine Manufacturing Company produces eavy chemical, food, and oil refinery equipent. An active expansion program is anned for the Mount Vernon Car Manucturing Company according to T. M. vans, president of Porter, with new types, cluding a line of tank cars, being added its present line of box cars, gondolas, frigerator cars and cabooses. Development of tank cars for better transport of emical products will be undertaken in coeration with the company's process equipent division.

◆

NATIONAL MALLEABLE & STEEL CASTINGS OMPANY.—*Cleve H. Pomeroy* has been ected vice-president of the National Malleble & Steel Castings Company. Mr. Pomroy, who will continue also as secretary d treasurer of the company, was a gradte of Western Reserve University in 1912. e joined National Malleable in 1920 as edit manager and was appointed assistant easurer in 1926, treasurer in 1935, and ected to the board of directors in 1938.

◆

REPUBLIC STEEL COMPANY.—*William F. osmer*, who has been associated with the eel section of the War Production Board, s rejoined the Republic Steel Corporation manager of railroad sales to succeed *Emtt Conneely*, deceased. Before entering

William F. Vosmer

vernment service, Mr. Vosmer was maner of sales of the Bar division of Repub. Mr. Vosmer started his career in the l business as a salesman in the employ the Cambria Steel Company. Succesely he became assistant manager of the ructural and Plate division of the Mide Steel and Ordnance Company and vicesident in charge of sales of the Donner el Company, which position he held until company became a part of Republic in 30.

◆

AMERICAN BRAKE SHOE COMPANY.—The erican Brake Shoe Company has opened ew experimental foundry at Mahwah, J. The new plant, which will do experintal work only, is a full-sized foundry able of handling castings up to 2,000 lb. ss weight. The foundry will be devoted war work for the duration. After the r its principal activity will be experintal and research work for Brake Shoe and its customers, including the investigation of new processes or products of interest to any of the company's hot metal divisions and the improvement of present products by changes in foundry practices, melting techniques, and rigging. The company also plans to put apprentices through a short training period in the foundry and then release them as they may be needed to the operating division.

◆

ALLEGHENY LUDLUM STEEL CORPORATION.—*Russell M. Allen*, general manager of sales of the Allegheny Ludlum Steel Corporation, has been elected vice-president in charge of sales. *P. E. Floyd*, sales manager, Chicago district, has been appointed assist-

Russell M. Allen

ant general manager of sales, with headquarters at the company's main office at Brackenridge, Pa. Mr. Floyd recently returned to Allegheny Ludlum from Washington, D. C., where he was chief of the stainless section of the steel division of the War Production Board. *W. G. McFadden*, formerly assistant district sales manager, Chicago office, has been appointed district manager of that territory.

Russell M. Allen entered the employ of the Allegheny Steel Company in January, 1920, as a production man in the mill. Two years later he entered the sales department and in 1923 was transferred to Detroit, Mich., as a member of the sales organization in that city. After two years of service in Detroit he was made district manager of the Chicago territory, which position he held until 1934 when he was appointed assistant sales manager at Brackenridge, Pa. He held this position through the merger and formation of the Allegheny Ludlum Steel Corporation in 1938 and in 1940 was promoted to general manager of sales.

◆

CRANE COMPANY.—*James A. Dwyer* has been appointed general manager of sales and branches of the Crane Company with headquarters in Chicago. Mr. Dwyer joined the Crane organization in 1917 at the Philadelphia, Pa., branch. He has been successively estimator, salesman, chief clerk, branch sales manager, assistant branch manager, branch manager, and district manager. He was appointed manager of branch houses about a year ago and will continue in that capacity in addition to assuming his new duties.

◆

VAN DER HORST CORPORATION.—*H. P. Munger* has been appointed plant manager at Olean, N. Y., for the Van der Horst Corporation of America.

◆

NATIONAL BRAKE COMPANY.—*E. C. Mersereau*, vice-president in charge of sales of "Peacock" hand brakes for the National Brake Company, has been elected executive vice-president and a director of the company. Mr. Mersereau has been associated with the company in engineering and sales activities since 1930. He was associated with the New York Central from 1920 to 1930 and was designing engineer of the car department when he transferred to the National Brake Company.

◆

UNITED STATES RUBBER COMPANY.—*W. S. Long*, formerly operations manager of the United States Rubber Company's Los Angeles, Calif., plant, has been appointed Pacific coast sales manager, mechanical goods. Mr. Long will continue in charge of the company's war products activities on the Pacific Coast.

◆

DUFF-NORTON MANUFACTURING COMPANY.—The Duff-Norton Manufacturing Company of Pittsburgh, Pa., has moved its eastern district office in New York from the Empire State Building to 250 Park avenue.

◆

MINNEAPOLIS - HONEYWELL REGULATOR COMPANY.—*Karl Schick*, Chicago zone supervisor of Minneapolis-Honeywell air-conditioning controls division, has been appointed sales manager of the company's newly-formed railway controls division. *George Badger* and *Alan Buckley* have been appointed assistants to Mr. Schick, and *James Locke*, of the Chicago zone, has been appointed to Mr. Schick's former position.

◆

HENNESSY LUBRICATOR COMPANY.—*W. Edgar Hamsher* has been elected vice-president in charge of sales and servicing, Chicago territory, with offices at 80 East Jackson boulevard, Chicago. *E. W. Kavanaugh* has been elected vice-president in charge of sales and servicing for the southern territory, with headquarters in Roanoke, Va.

◆

MIDVALE COMPANY.—*Henry H. Ziesing* has been elected vice-president in charge of sales of the Midvale Company to succeed *Stuart Hazlewood*, who has resigned after more than 41 years with the company.

◆

LUKENS STEEL COMPANY.—*Arthur J. O'Leary* has been appointed assistant manager of sales, and *George W. Eshleman*, assistant to the manager of sales, of the Lukens Steel Company. Mr. O'Leary joined the Lukens Steel Company in December, 1926, and was transferred to the sales department in 1931. From 1941 to 1943, he served in an advisory capacity in the steel division of the War Production Board. Mr. Eshleman joined Lukens in 1927, and has served in the company's sales department since 1935.

(Turn to second left-hand page)


SPOTLIGHTING DIESEL SERVICE
BALTIMORE AND OHIO
GENERAL MOTORS
LOCOMOTIVES

Electric Service Manufacturing Company.—The Electric Service Supplies Company has changed its name to the Electric Service Manufacturing Company. *A. H. Englund,* executive vice-president, has been elected president of the company, and *J. R. McFarlin,* electrical engineer, has been elected secretary.

◆

Electro-Motive Division, General Motors Corporation.—*H. B. Ellis,* service manager, Electro-Motive Division, General Motors Corporation, has been given the title of director of parts and service. *D. H. Queeney,* formerly in the engineering and sales departments, has been appointed service manager, reporting to Mr. Ellis. *W. D. Davis,* formerly assistant service manager, has been appointed parts service manager, also reporting to Mr. Ellis. *Victor E. Rennix,* formerly sales representative at the Chicago office of the Baldwin Locomotive Works, and for the last two years associated with the Transportation Section of the War Production Board, has joined the sales staff of the Electro-Motive Division, General Motors Corporation with headquarters at LaGrange, Ill.

Obituary

William J. Davis, Jr., retired consulting transportation engineer of the General Electric Company, died February 21 at Ellis Hospital, Schenectady, N. Y., after a long illness. Mr. Davis will be remembered in the railroad field for making an exhaustive pioneer study of the subject of train resistance. The "Davis Formula," which he developed, is still the generally accepted means of calculating train resistance. He also introduced forced ventilation for railway cars. He was born in Louisville, Ky., May 13, 1868, and was a graduate of Rose

William J. Davis, Jr.

Polytechnic Institute in 1892. Mr. Davis was first employed by General Electric in the company's test course at Lynn, Mass. After completing several of the regular apparatus tests, he was placed in charge of the calculating room of the testing department. He left the company in 1893 but returned in February, 1895. In May, 1899, he was named assistant engineer in the G-E railway engineering department, where he carried out special engineering work in connection with the Detroit River Tunnel electrification, as well as the electrification of the New York Central, West Jersey & Seashore and a number of other electric railway systems. Mr. Davis became engineer of the company's Pacific Coast District in San Francisco, Calif., in 1908. During a portion of this time he was chief engineer of the Mexican Northern Power Co. and was in charge of the engineering features of the Boquilla development of that company at Chihuahua. In 1921, Mr. Davis was transferred to the G-E railway engineering department at Schenectady. When that department became known as the transportation engineering department, in 1929, he was appointed a consulting engineer. He retired on September 1, 1930.

◆

William George Kranz, former vice-president and a director of the National Malleable & Steel Castings Co., died early in March. Mr. Kranz joined National Malleable as works manager of the Sharon, Pa., plant in 1899, and was transferred to Cleveland, Ohio, in 1916, as vice-president in charge of operations. He retired in 1938.

◆

Jesse Jay Ricks, chairman of the board of the Union Carbide & Carbon Corporation, died on February 20. Mr. Ricks was 64 years of age. He was a graduate of the University of Michigan in 1901, and received a bachelor of laws degree from the Michigan Law School in 1903. He joined the newly formed Union Carbide Corporation in 1917, and later was appointed chief counsel. He was elected president in October, 1925, and chairman of the board in 1941.

Personal Mention

General

Lester H. Kueck, chief mechanical engineer of the Missouri Pacific, with headquarters at St. Louis, Mo., has been appointed to fill the newly created position of

Lester H. Kueck

assistant chief mechanical officer of the Missouri Pacific Lines, with headquarters at St. Louis. Mr. Kueck was born on July 20, 1895, at Sedalia, Mo., and entered the service of the Missouri Pacific on April 1, 1917, as a general draftsman. From September 21, 1920, to February 15, 1924, Mr. Kueck served as a general draftsman on the Texas & Pacific at Marshall, Tex. At the end of this period he returned to the Missouri Pacific as a general draftsman at St. Louis, and on February 2, 1926, became chief draftsman. On September 1, 1935, Mr. Kueck was appointed assistant chief mechanical engineer, and in September, 1937, chief mechanical engineer.

Charles C. Richardson, assistant to superintendent motive power of the Bessemer & Lake Erie at Greenville, Pa., has retired after serving 53 years. The position of assistant to superintendent motive power has been discontinued.

William H. McAmis has resigned as general foreman of the Missouri Pacific, at St. Louis, Mo., to fill the newly created position of chief mechanical inspector of the Chicago & North Western, at Chicago.

Samuel B. Schenk, special engineer of the Bessemer & Lake Erie, has been appointed assistant engineer motive power, with headquarters at Greenville, Pa. The position of special engineer has been abolished.

Fred A. Baldinger, whose appointment as superintendent of motive power, Eastern region, of the Baltimore & Ohio, with headquarters at Baltimore, Md., was announced in the February issue, was born at Crest-

Fred A. Baldinger

line, Ohio, on August 23, 1881. After serving from 1903 until 1908 on the Pennsylvania, Mr. Baldinger entered the employ of

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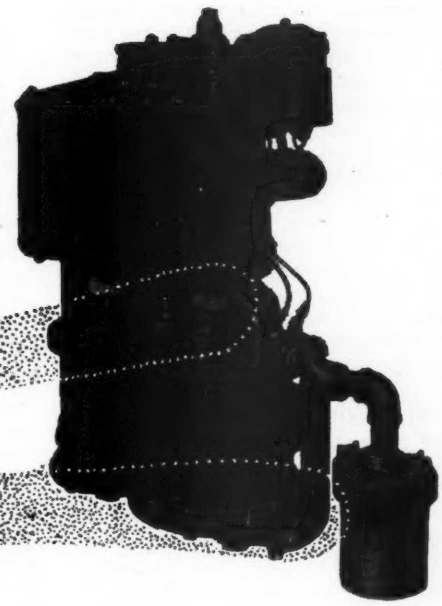
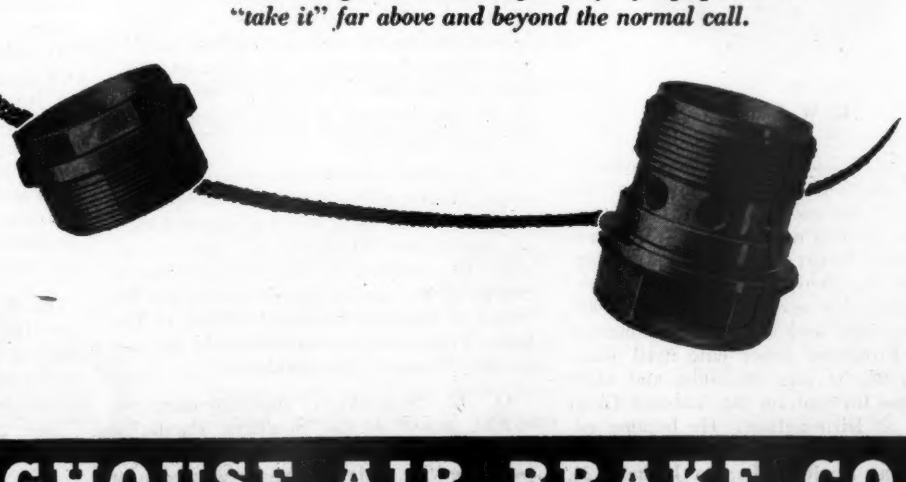
High Standards Maintained for Compressor Replacement Parts



Our "know-how" of air compressor replacement parts has a background of three generations . . . knowing the best available material for the job . . . possessing the craftsmanship to do it well.

There is no let-down in standards . . . the same high quality built into the original is maintained in the replacement, a policy that extends compressor service life with top efficiency.

It is a small part of the proud story of war time railroading — the amazing ability of equipment to "take it" far above and beyond the normal call.



WESTINGHOUSE AIR BRAKE CO.

WILMERDING, PENNSYLVANIA

the Washington Terminal as machinist and gang foreman, filling that post until 1912. In December, 1913, he became assistant foreman at the Mt. Clare shop of the Baltimore & Ohio at Baltimore, and in January, 1916, was transferred to Holloway, Ohio, as enginehouse foreman. After serving as general foreman and assistant master mechanic at Holloway, he was appointed master mechanic at Cassaway, W. Va., in March, 1919. Mr. Baldinger was transferred to Benwood, W. Va., in February, 1920, and to Baltimore in May, 1929, as master mechanic of the Wheeling and Baltimore divisions, respectively. He became district master mechanic at Baltimore on May 1, 1936, and superintendent of motive power, Eastern region, early this year.

G. O. WILLHIDE, acting superintendent motive power of the Western Maryland at Hagerstown, Md., has been assigned to other duties and the position of acting superintendent motive power has been abolished.

CHARLES W. MATHEWS, who has been appointed assistant superintendent of machinery of the Louisville & Nashville at Louisville, Ky., as announced in the March issue, was born on July 14, 1884, at Lyons, Mich. He received a high school education and entered the employ of the Louisville & Nashville on June 3, 1900, completing his apprenticeship and serving as a machinist at Decatur, Ala., until May 12, 1904. From

C. W. Mathews

that date until June, 1905, he was consecutively a machinist in the employ of the Nashville, Chattanooga & St. Louis and Tennessee Central at Nashville, Tenn., and the Alabama Great Southern at Birmingham, Ala. He then returned to the Louisville & Nashville and until May 28, 1907, was a machinist and foreman, Birmingham district. From the latter date until January 23, 1908, he was machinist and night enginehouse foreman on the Alabama Great Southern at Birmingham. He became enginehouse foreman of the Louisville & Nashville at Boyles, Ala., on January 23, 1908; general foreman at Anniston, Ala., on May 3, 1913; and from May 31, 1917, until March 1, 1919, was assistant master mechanic and master mechanic at Covington, Ky. He returned to Decatur on March 1, 1919, as master mechanic; on February 1, 1936, was appointed general master mechanic at Louisville, and on January 1, 1944, became assistant superintendent of machinery at Louisville.

HARRY D. WEBSTER, engineer motive power of the Bessemer & Lake Erie at Greenville, Pa., has resigned after 33 years in the service of the road.

ORTON JONES, streamliner electrician of the Chicago & North Western, has been appointed Diesel supervisor for the system. Mr. Jones' headquarters are at Chicago.

W. A. LANGLANDS, master mechanic of the Galena division of the Chicago & North Western, with headquarters at Chicago, has been appointed superintendent of Diesel and motor car equipment with headquarters at Chicago.

F. E. MALLOY, master mechanic of the San Joaquin division of the Southern Pacific at Bakersfield, Calif., has been appointed assistant superintendent of motive power, with headquarters at Sacramento, Calif.

GEORGE W. BOHANNON has resigned as mechanical engineer of the Duluth, Missabe & Iron Range, at Duluth, Minn., to fill the newly created position of assistant to the chief mechanical officer of the Chicago & North Western at Chicago.

F. J. THOMAS, supervisor of electrical appliances and Diesel locomotives of the Indiana Harbor Belt at Gibson, Ind., has been appointed to fill the newly created position of supervisor of Diesel locomotive maintenance of the New York Central at New York.

E. E. HINCHMAN, assistant superintendent of motive power of the Southern Pacific, at Sacramento, Calif., has been appointed superintendent of motive power, with headquarters at Los Angeles, Calif. A sketch of Mr. Hinchman's career appeared in the May, 1942, issue of the *Railway Mechanical Engineer* at the time of his appointment as assistant superintendent of motive power.

W. R. SEDERQUEST has been appointed superintendent of steam locomotive maintenance of the New York, New Haven & Hartford, with headquarters at Boston, Mass. A sketch and photograph of Mr. Sederquest appeared in the January, 1942, *Railway Mechanical Engineer,* at the time of his appointment as shop superintendent at Readville, Mass.

C. J. WOLFE, superintendent motive power of the Western Maryland with headquarters at Hagerstown, Md., who was granted leave of absence on September 15, 1942, to assume the position of associate director in charge of the mechanical section of the Division of Railway Transport, Office of Defense Transportation, has return to his post on the Western Maryland.

O. B. SCHOENKY, superintendent of motive power of the Southern Pacific at Los Angeles, Calif., has retired after 51 years' service. Mr. Schoenky was born at St. Louis, Mo., on March 25, 1875, and entered railway service in 1897 as an apprentice in the employ of the Missouri Pacific at St. Louis. Later he was draftsman and finisher in the service of the American Car and Foundry Company, at St. Charles, Mo., and draftsman for the Pullman Company, at Pullman, Ill., and Buffalo, N. Y. In 1901 he went to Sacramento, Calif., as a draftsman for the Southern Pacific and subsequently served as chief car draftsman, general foreman and shop superintendent. In 1917 Mr. Schoenky was appointed master mechanic at Tucson, Ariz., and in 1925, superintendent of motive power at Los Angeles.

ROY C. BEAVER, assistant engineer motive power of the Bessemer & Lake Erie, has been appointed engineer motive power with headquarters at Greenville, Pa. Mr. Beaver was born at Greenville on August 29, 1889. He was a graduate of Thiel College in

Roy C. Beaver

1913 and entered railroad service the same year as mechanical draftsman in the employ of the Bessemer & Lake Erie. In 1918, Mr. Beaver was appointed assistant mechanical engineer, and in 1933, assumed special duties in the car department on the development of lightweight cars. In 1939 he was named assistant engineer motive power.

JAMES FRAZER SMITH, who has retired as superintendent of motive power and car equipment, Northern Ontario district, of the Canadian National, as announced in the March issue, was born at Montreal, Que. He entered the motive-power department of the Grand Trunk (now Canadian National) in July, 1893, and subsequently became fitter and machinist. In February, 1918, he went to Ottawa, Ont., as erecting shop foreman; in November, 1919, was transferred to Toronto, Ont., as general foreman of the Toronto shop, and in April, 1930, was appointed superintendent of motive power and car equipment.

H. R. KOONCE, locomotive engineman of the Illinois Central, with headquarters at Fulton, Ky., has been appointed division fuel engineer, with headquarters at Waterloo, Iowa.

Master Mechanics and Road Foremen

C. F. SCHWARTZ has been appointed master mechanic of the Erie, with headquarters at Avoca, Pa.

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KEEPING PACE WITH THE NATION'S NEEDS

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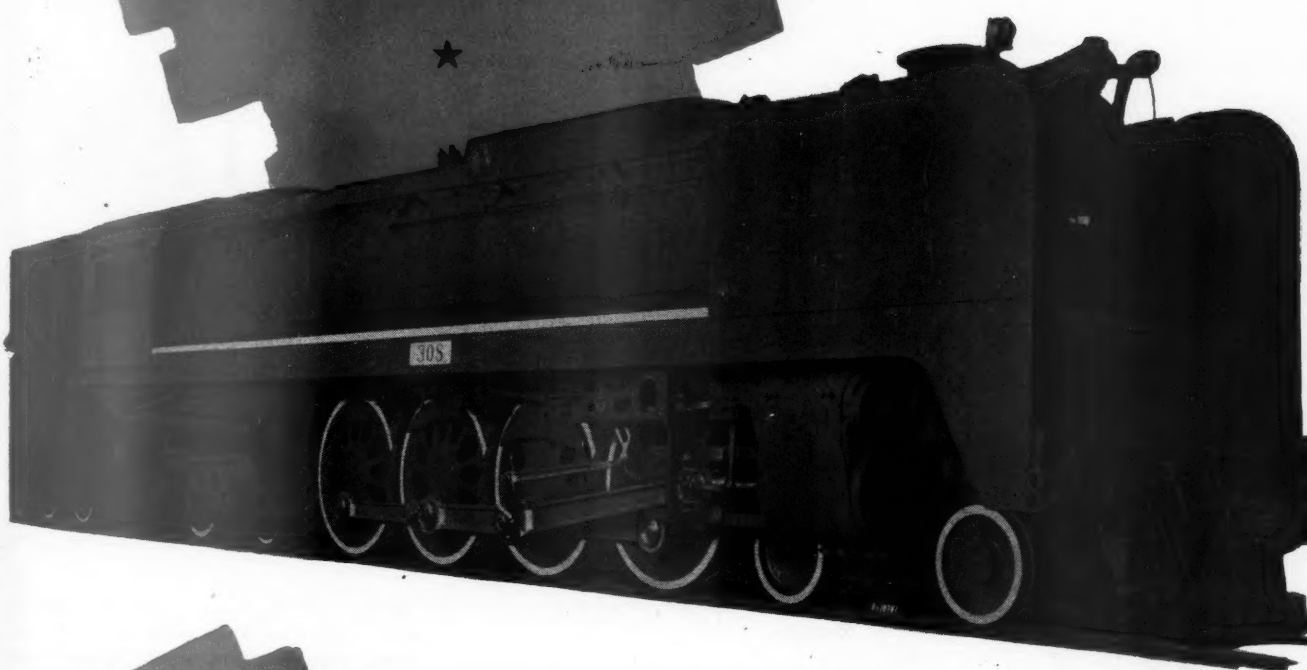

Fifteen 4-8-4's were delivered by Alco to the Delaware & Hudson in 1943. This makes a fleet of 50—fifteen 4-8-4's and thirty-five 4-6-6-4's—high-speed, high-powered, heavy tonnage locomotives which Alco has delivered to this road since July 1940.

Locomotive Characteristics

Weight on Drivers	270,000 Lb.
Weight of Engine	470,000 Lb.
Cylinders	24½ x 32 Ins.
Diameter of Drivers	75 Ins.
Boiler Pressure	285 Lb.
Tractive Power	62,040 Lb.
Tender Capacity—Water	20,000 Gals.
Tender Capacity—Fuel	25 Tons

Alco

"The D&H"

AMERICAN LOCOMOTIVE

Buy War Bonds

MANUFACTURERS OF MOBILE POWER

STEAM, DIESEL AND ELECTRIC LOCOMOTIVES, MARINE DIESELS, TANKS, GUN CARRIAGES & OTHER ORDNANCE

F. J. Garner has been appointed master mechanic of the Alabama, Tennessee & Northern.

R. Micel, general foreman of the Chicago & North Western at Clinton, Iowa, has been appointed master mechanic of the Galena division, with headquarters at Chicago.

J. Walker, assistant master mechanic of the Wichita division of the Missouri Pacific at Wichita, Kan., has been transferred to the position of assistant master mechanic of the Kansas City Terminal division, with headquarters at Kansas City, Mo.

A. Walker, assistant master mechanic of the Kansas City Terminal division of the Missouri Pacific at Kansas City, Mo., has been appointed master mechanic of the Central Kansas-Colorado division, with headquarters at Osawatomie, Kan.

L. E. Allard, master mechanic of the Central Kansas-Colorado division of the Missouri Pacific at Osawatomie, Kan., has been appointed assistant master mechanic of the Wichita division, with headquarters at Wichita, Kan.

Norman V. Hendy, who has been appointed master mechanic of the Northern Pacific, with headquarters at Glendive, Mont., as announced in the February issue, was born on March 10, 1890, at Bellevue,

N. V. Hendy

Idaho. He attended grammar schools at Butte, Mont., and on May 20, 1906, entered the service of the Northern Pacific as a hostler helper at Butte, Mont. He became locomotive fireman on December 7, 1906, and locomotive engineman on April 13, 1914. On February 1, 1939, he was appointed road foreman of engines at Livingston, Mont., and on November 15, 1939, was transferred to the position of road foreman of engines at Missoula, Mont. He was appointed master mechanic at Glendive on January 1, 1944.

F. D. Dunton, master mechanic of the Erie at Avoca, Pa., has been granted a leave of absence to accept a commission in the United States Army.

Thomas E. Dunn, general inspector of the motive power department of the Delaware, Lackawanna & Western at Scranton, Pa., has been promoted to the position of master mechanic of the Morris and Essex Division, with headquarters at Hoboken, N. J.

T. M. Conniff, master mechanic of the Morris & Essex Division of the Delaware, Lackawanna & Western at Hoboken, N. J., has been transferred to the Scranton division, with headquarters at Scranton, Pa.

Michael B. O'Meara, general enginehouse foreman of the Delaware, Lackawanna & Western at Scranton, Pa., has been promoted to the position of master mechanic, with headquarters at Buffalo, N. Y.

J. J. Nelson, master mechanic of the Delaware, Lackawanna & Western at Buffalo, N. Y., has resigned.

Lewis Vickers has been appointed master mechanic of the Maryland & Pennsylvania, and will continue to perform the duties of shop foreman.

Shop and Enginehouse

W. S. Garrett, mechanical inspector in the office of the general superintendent motive power of the Norfolk & Western at Roanoke, has been promoted to the position of general foreman at Crewe, Va.

J. R. Wheary, general foreman in the shops of the Norfolk & Western at Crewe, Va., has retired.

F. C. Noel, passenger car shop foreman in the shops of the Norfolk & Western at Roanoke, Va., has been promoted to the position of mechanical inspector in the office of the general superintendent motive power at Roanoke.

Arthur E. May has been appointed general foreman of the New York, New Haven & Hartford at Van Nest, N. Y.

Francis Whitaker has been appointed superintendent of shops of the Boston & Maine, with headquarters at Readville, Mass.

J. Martin, general foreman of the Cleveland, Cincinnati, Chicago & St. Louis at Beech Grove, Ind., has been appointed shop superintendent, with headquarters at Beech Grove.

M. A. R. Slack, general foreman of the New York, New Haven & Hartford at Van Nest, N. Y., has been appointed to fill the newly created position of assistant shop superintendent at Van Nest.

Car Department

C. S. Patton, Jr., gang foreman at the Lambert Point shop of the Norfolk & Western, has been promoted to the position of passenger-car shop foreman at Roanoke, Va.

Arthur H. Keys, who has been appointed assistant superintendent, car department, of the Baltimore & Ohio, with headquarters at Baltimore, Md., as announced in the February issue, was born on September 21, 1899, at Baltimore. He entered the employ of the Baltimore & Ohio at Pittsburgh, Pa., on February 13, 1913. He became car foreman at Youngstown, Ohio, on January 16, 1918; safety appliance inspector at Baltimore on July 1, 1918; chief joint car inspector at Baltimore on October 1, 1920; general foreman car shops, Curtis Bay, Baltimore, on May 22, 1922; general car foreman, Baltimore division,

A. H. Keys

on July 16, 1925; general car foreman, Pittsburgh, on October 1, 1918; master car builder of the Pennsylvania-New York District, with headquarters at Pittsburgh, on August 1, 1933, and on January 1, 1944, was transferred to Baltimore as assistant superintendent, car department. Mr. Keys is a member of the A.A.R. Committee on Loading Rules.

George W. Ditmore, master car builder of the Delaware & Hudson, has been appointed superintendent of car equipment at Albany, N. Y. Mr. Ditmore's former position has been abolished.

Obituary

Harry Carlisle Young, purchasing agent of the Delaware & Hudson, died on February 15 after a brief illness.

Dumont Love, general mechanical inspector of the Florida East Coast, died on January 2. He was 71 years old.

John Rolley Gould, assistant to superintendent of motive power of the Chesapeake & Ohio, died on February 19 at Richmond, Va. Mr. Gould was born on August 11, 1869. He entered the service of the Chesapeake & Ohio in 1883 as a machinist apprentice in the shops at Huntington, W. Va. He became gang foreman at Huntington in 1887; general foreman machine department at Richmond in 1892; general foreman at Huntington in 1899; assistant master mechanic, Clifton Forge division, on September 1, 1902; master mechanic, Clifton Forge division, on January 7, 1903; master mechanic, Richmond division, on August 1, 1903, and division superintendent motive power, Eastern General division, on May 1, 1910. Mr. Gould was appointed

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general superintendent of motive power on July 1, 1912, and a short time later his title was changed to superintendent of motive power. He was assigned to other duties on April 20, 1923; became chief mechanical officer on November 15, 1923, and assistant to superintendent motive power on May 1, 1930.

J. C. Hassett, assistant to general mechanical superintendent of the New York, New Haven & Hartford, at New Haven, Conn., died on February 29 at New Haven. Mr. Hassett was born on May 21, 1882, at Susquehanna, Pa., and received his education at Laurel Hill Academy. He entered his railroad career on August 22, 1898, as a clerk in the mechanical engineer's office of the Erie, in which position he

J. C. Hassett

remained until 1899. He continued in the employ of the Erie until 1902 as a machinist apprentice; until 1907 as a draftsman, and until 1910 as technical instructor of apprentices. He then served consecutively as a draftsman in the employ of the Union Pacific, the Baltimore & Ohio, and (1911) the New York, New Haven & Hartford. He was appointed chief draftsman on the latter road in 1912; mechanical engineer in 1918, and assistant to general mechanical superintendent in 1935.

Trade Publications

Copies of trade publications described in the column can be obtained by writing to the manufacturers, preferably on company letterhead, giving title. State the name and number of the bulletin or catalog desired, when it is mentioned.

"Preventing Welding and Cutting Fires."—International Acetylene Association, 30 East Forty-Second street, New York. Sixteen-page brochure of rules and recommendations based on the combined experience of oxy-acetylene equipment users, equipment manufacturers, and members of the National Fire Protection Association, National Safety Council, and International Acetylene Association.

"Aluminum Imagineering Notebook."—Aluminum Company of America, Pittsburgh 19, Pa. Presents twelve important economic advantages of aluminum and illustrates, in the interests of postwar activities, numerous examples of things which have been "imagineered" into aluminum actualities.

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Vertical Boring Mills.—The Cincinnati Planer Company, Cincinnati 9, Ohio. Bulletin 131 illustrates and describes Cincinnati Hypro vertical boring mills (54-in., 64-in., 6-ft., 7-ft., and 7-ft. widened to 8 ft.).

◆

Electrical Connectors.—Burndy Engineering Co., Inc., New York. Sixty-four-page catalog of indent type electrical connectors for wires and cables. Sleeve of this type of connector, after being slipped on cable, is indented by means of a special tool to make a permanent electrical and mechanical connection. Connectors available for both solid and stranded wire and made in a variety of forms for wire sizes from No. 22 to 2,000,000 c.m.

◆

Gages and Gage Instruments.—Continental Machines, Inc., 1301 Washington avenue South, Minneapolis 4, Minn. "Quality Control with DoAll Gages and Gage Instruments," a 64-page pocket-size handbook of scientific inspection, with tables and data pertaining to gaging methods used in precision measurement.

◆

V-Belt Drives.—Dayton Rubber Manufacturing Company, Dayton 1, Ohio. 384-page pocket-size *Catalog No. 280.* Sections in color index the six main sections on V-Belt Drives (for standard motor speeds); V-Flat Drives; Supplementary Drive Tables; Engineering Data (special drives); prices and dimensions, and Interchangeability List. *Forty-page illustrated booklet,* pocket-size. Parts list and installation instructions for Dayton D-R V-belt drives. All types of V-belt connectors and application tools illustrated and proper use described. Includes also catalog lists of various types and sizes of V-belts, both open-end and endless.

◆

Packings.—Green, Tweed & Co., Bronx Boulevard at Two Hundred Thirty-Eighth Street, New York 66. Four-page bulletin on G-T packings tabulates a number of different fluids handled in process work and general plant services and lists the proper packing for each liquid, gas and vapor. Describes also the form and construction of each packing and lists typical kinds of equipment for which each is suited.

◆

Electric Trucks.—Baker Industrial Truck Division, Baker-Raulang Company, 2168 West Twenty-Fifth street, Cleveland 13, Ohio. Catalog No. 52, twenty pages, printed in color. Lists all standard Baker electric trucks; gives information on material handling with power trucks, and illustrates special models designed for unusual handling operations.

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"Hauck Industrial Combustion Data."—Hauck Manufacturing Co., 124-136 Tenth street, Brooklyn 15, N. Y. A 112-page illustrated reference for combustion engineers, operating and maintenance engineers, designers and builders of industrial heating equipment, metallurgists, etc., concerned with the selection, installation, operation and maintenance of combustion equipment, either oil or gas, on furnace, ovens, kilns, retorts, and other heat processing equipments.

* * *

A U. S. Army 2-8-0 "Austerity" locomotive undergoing final adjustments in the shops of the Southern Railway of England preparatory to making its trial trip—A number of these locomotives are performing freight service on the British railways


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